NATIONAL CAMERA, INC.
Technical Training Division
(National Camera Repair School)

Englewood,
Colorado
80110

Litho in U.S.A.

Nat Cam **Manual**
327

The Leica IIIf

G.E. #11 - Sylvania #40	
Shutter Speed	Sync Dial Setting
Open to 1/25 second	14
1/50 second	11
1/75 second	6
1/100 second	4
1/200 - 1/250 second	2
1/500 second	1
1/1000 second	0

G.E. #50 - Sylvania #3	
Shutter Speed	Sync Dial Setting
Open to 1/25 second	14
1/50 second	13
1/75 second	7
1/100 second	4
1/200 - 1/250 second	2
1/500 second	1
1/1000 second	0

G.E. #22 - Sylvania #2	
Shutter Speed	Sync Dial Setting
Open to 1/25 second	16
1/50 second	13
1/75 second	7
1/100 second	4
1/200 - 1/250 second	2
1/500 second	1
1/1000 second	0

G.E. #31 - Sylvania #2A	
Shutter Speed	Sync Dial Setting
Open to 1/25 second	16
1/50 second	13
1/75 second	7
1/100 second	4
1/200 - 1/250 second	2
1/500 second	1
1/1000 second	0

BLUE BULBS

G.E. #6B - Sylvania #26B	
Shutter Speed	Sync Dial Setting
Open to 1/25 second	16
1/50 second	13
1/75 second	7
1/100 second	4
1/200 - 1/250 second	2
1/500 second	1
1/1000 second	0

G.E. #31B - Sylvania #2A-B	
Shutter Speed	Sync Dial Setting
Open to 1/25 second	16
1/50 second	13
1/75 second	7
1/100 second	4
1/200 - 1/250 second	2
1/500 second	1
1/1000 second	0

G.E. #11B - Sylvania #40B	
Shutter Speed	Sync Dial Setting
Open to 1/25 second	14
1/50 second	11
1/75 second	6
1/100 second	4
1/200 - 1/250 second	2
1/500 second	1
1/1000 second	0

G.E. #5B - Sylvania #25B	
Shutter Speed	Sync Dial Setting
Open to 1/25 second	14
1/50 second	11
1/75 second	6
1/100 second	4
1/200 - 1/250 second	2
1/500 second	1
1/1000 second	0

G.E. #50B - Sylvania #3B	
Shutter Speed	Sync Dial Setting
Open to 1/25 second	14
1/50 second	13
1/75 second	7
1/100 second	4
1/200 - 1/250 second	2
1/500 second	1
1/1000 second	0

G.E. #22B - Sylvania #2B	
Shutter Speed	Sync Dial Setting
Open to 1/25 second	16
1/50 second	13
1/75 second	7
1/100 second	4
1/200 - 1/250 second	2
1/500 second	1
1/1000 second	0

CONTENTS

THE LEICA IIIf

Disassembly of the Leica IIIf 1
Flash Sync in the Leica IIIf 10
Top Cover Removal of the Leica IIIf 16
Front and Bottom Plate Removal of the Leica IIIf 32
Reassembly of the Leica IIIf 55
Timing the Shutter Speeds in the Leica IIIf 63
Adjusting the Rangefinder in the Leica IIIf 71
Adjustment of the Contact Cam in the "Red Dial" Leica IIIf . . 71
Other Leica Rangefinder Models 74
Sync Dial Tables for Leica "f" Series 76

written and illustrated by
Larry Lyells

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BLUE BULBS

G.E. #6B - Sylvania #26B	
Shutter Speed	Sync Dial Setting
Open to 1/30 second	17
1/40 second	11
1/60 second	8
1/100 second	6.5
1/200 - 1/250 second	4
1/500 second	3.5
1/1000 second	2.5

G.E. #31B - Sylvania #2A-B	
Shutter Speed	Sync Dial Setting
Open to 1/30 second	20
1/40 second	15
1/60 second	10
1/100 second	7
1/200 - 1/250 second	5
1/500 second	4
1/1000 second	2.5

G.E. #11B - Sylvania #40B	
Shutter Speed	Sync Dial Setting
Open to 1/30 second	17
1/40 second	11
1/60 second	8
1/100 second	5.5
1/200 - 1/250 second	4
1/500 second	3.5
1/1000 second	2

RED DIAL

ELECTRONIC FLASH	
Shutter Speed	Sync Dial Setting
1/25 second	0
1/50 second	20

CLEAR BULBS

G.E. #5 - Sylvania #0 and #25	
Shutter Speed	Sync Dial Setting
Open to 1/25 second	14
1/50 second	11
1/75 second	6
1/100 second	4
1/200 - 1/250 second	2
1/500 second	1
1/1000 second	0

G.E. #22B - Sylvania #2B	
Shutter Speed	Sync Dial Setting
Open to 1/30 second	16
1/40 second	11
1/60 second	8
1/100 second	5
1/200 - 1/250 second	4
1/500 second	3
1/1000 second	2

G.E. #50B - Sylvania #3B	
Shutter Speed	Sync Dial Setting
Open to 1/30 second	19
1/40 second	14
1/60 second	9.5
1/100 second	7
1/200 - 1/250 second	5.5

G.E. #5B - Sylvania #25B	
Shutter Speed	Sync Dial Setting
Open to 1/30 second	16
1/40 second	11
1/60 second	8
1/100 second	5.5
1/200 - 1/250 second	4
1/500 second	3.5
1/1000 second	2

G.E. #6 - Sylvania #26	
Shutter Speed	Sync Dial Setting
Open to 1/25 second	16
1/50 second	13
1/75 second	7
1/100 second	4
1/200 - 1/250 second	2
1/500 second	1
1/1000 second	0

G.E. #SM - Sylvania #3F	
Shutter Speed	Sync Dial Setting
Open to 1/25 second	0

G.E. #M-2 - Sylvania #M-2	
Shutter Speed	Sync Dial Setting
Open to 1/25 second	7
1/50 second	7

SYNC DIAL TABLES FOR LEICA "f" SERIES

The following tables can be used to find the proper sync dial setting for the particular combination of flashbulb and shutter speed. To use the tables, first decide if the camera is a "red dial" or a "black dial" model. Next, locate the desired flashbulb under the appropriate section. Read down in the "Shutter Speed" column to find the shutter speed you are using - the correct sync dial setting can then be found to the right of the shutter speed. For example, suppose that you wish to test the flash synchronization on a "black dial" Leica IIIf when using a G.E. #5 flashbulb at 1/60 second. You will find the correct table in the "Clear Bulbs" portion of the "Black Dial" section. Once you have located the proper table for the G.E. #5 flashbulb, you will find that "8" is the sync dial setting you must use at 1/60 second.

BLACK DIAL

ELECTRONIC FLASH	
Shutter Speed	Sync Dial Setting
1/30 second	2

CLEAR BULBS

G.E. #5 - Sylvania #0 and #25	
Shutter speed	Sync Dial Setting
Open to 1/30 second	16
1/40 second	11
1/60 second	8
1/100 second	5.5
1/200 - 1/250 second	4
1/500 second	3.5
1/1000 second	2

G.E. #22 - Sylvania #2	
Shutter Speed	Sync Dial Setting
Open to 1/30 second	16
1/40 second	11
1/60 second	8
1/100 second	5
1/200 - 1/250 second	4
1/500 second	3
1/1000 second	2

G.E. #31 - Sylvania 2A	
Shutter Speed	Sync Dial Setting
Open to 1/30 second	20
1/40 second	15
1/60 second	10
1/100 second	7
1/200 - 1/250 second	5
1/500 second	4
1/1000 second	2.5

G.E. #SM - Sylvania # SF	
Shutter Speed	Sync Dial Setting
Open to 1/30 second	4

G.E. #M-2 -- Sylvania # M-2	
Shutter Speed	Sync Dial Setting
Open to 1/30 second	14

G.E. #11 - Sylvania #40	
Shutter Speed	Sync Dial Setting
Open to 1/30 second	17
1/40 second	11
1/60 second	8
1/100 second	5.5
1/200 - 1/250 second	4
1/500 second	3.5
1/1000 second	2

G.E. #6 - Sylvania #26	
Shutter Speed	Sync Dial Setting
Open to 1/30 second	17
1/40 second	11
1/60 second	8
1/100 second	6.5
1/200 - 1/250 second	4
1/500 second	3.5
1/1000 second	2.5

G.E. #50 - Sylvania #3	
Shutter Speed	Sync Dial Setting
Open to 1/30 second	19
1/40 second	14
1/60 second	9.5
1/100 second	7
1/200 - 1/250 second	5.5

THE LEICA IIIf

DISASSEMBLY OF THE LEICA IIIf

There's an entire series of screw-mount Leicas. But all the models are very similar in design. The Leica IIIf, Fig. 1, has most of the refinements found in the screw-mount series. So it makes a good representative.

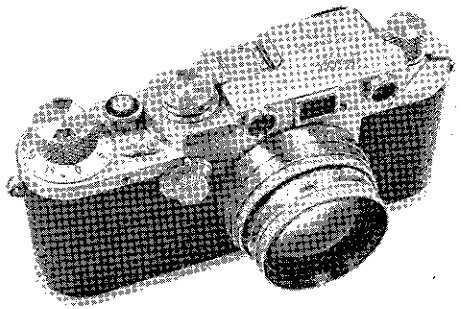


Figure 1

In the IIIf, Leica introduced internal flash synchronization with a variable delay. The IIIf also has a coupled rangefinder and a complete slow-speed range with an adjustable pallet.

Fig. 2 points out the parts at the top of the camera. Locate the wind knob, the release plunger, and the speed knob. Rotating the wind knob in the direction of its engraved arrow simultaneously advances the film and cocks the shutter. And the film counter dial, under the wind knob, advances one frame calibration at a time.

Turning the rewind knob winds the film back into the cassette. First, though, you must move the advance/rewind lever from the "A" (advance) position to "R" (rewind). The advance / rewind lever then disengages the first curtain wind gear and frees the sprocket.

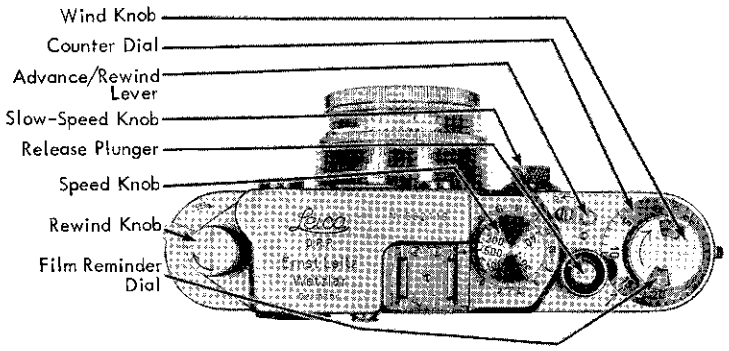


Figure 2

For compactness, the camera lens in some models is collapsible. When the camera is in use, the lens must first be pulled out to the extended position, Fig. 3, and turned slightly clockwise to lock it in place. Also, the helical focusing mount latches at the infinity position. In order to focus the lens at a closer distance, the infinity latch must first be depressed. Turning the lens to the correct distance setting simultaneously superimposes the coupled rangefinder images.

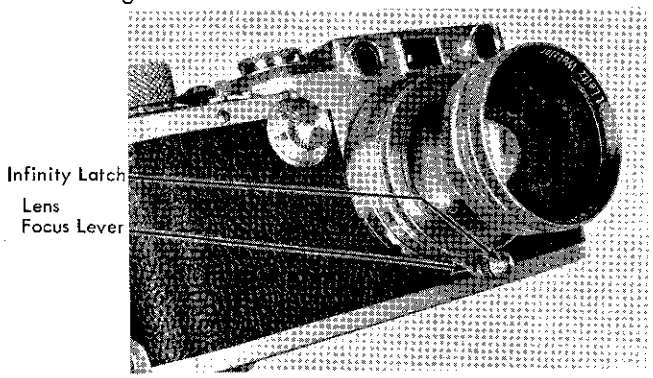


Figure 3

To remove the lens, simply unscrew it in a counterclockwise direction. You can now see the lever within the camera that couples the lens to a movable prism in the rangefinder, Fig. 4. When the lens is in place, the roller on the rangefinder lever rides against the back surface of the lens mount. Thus, as the lens is moved in or out to focus, the spring-loaded rangefinder lever follows its travel. This is a typical cam and lever rangefinder linkage system — the lens mount acts as a cam to actuate the rangefinder lever.

Leica "c" models, which preceded the "f" series, are also quite similar. However, these cameras do not have internal flash synchronization, a feature introduced with the IIIf. Also, in the older "c" models, the body shell cannot be removed with the slow-speed knob in place. You may identify this type of slow-speed knob by the presence of a large screw at its center. When the screw has been removed, the remaining parts of the slow-speed knob and cam may be disassembled. Then, the body shell may be removed in the normal manner.

During reassembly, the "c" model's slow-speed knob may be replaced in any one of four positions on the squared shaft of the slow-speed cam. Consequently, prior to installing the slow-speed knob, rotate the slow-speed cam gently and carefully in a counterclockwise direction until it comes to a stop. Since this is the 1/20-second setting, the slow-speed knob may be replaced with its 1/20-second calibration aligned accordingly.

For fine adjustments of the slow speeds, the rotational position of the slow-speed cam may be further altered to correspond with a calibrated exposure. The slow-speed knob is made in two sections which are locked together with a setscrew. This allows the calibrated portion of the slow-speed knob to be precisely set at the exposure which the shutter is actually delivering. To perform this test, it will be necessary to check the exposure at the various speeds indicated on the slow-speed knob and to move the calibrated dial accordingly.

After setting the slow-speed knob and testing the exposure, hold the slow-speed cam in position, loosen the setscrew, and move the calibrated dial until it agrees with the shutter speed delivered. This rotational movement in the "c" models is in contrast to the in-and-out adjustment of the slow speeds you observed in the Leica IIIf.

In the latest of the screw-mount Leicas, the IIIg, automatic parallax compensation and separate viewfinder frame lines for 50mm and 90mm lenses have been added to the basic pattern. Also, the flash synchronization has been simplified, as you will recall.

With the introduction of the M3, the buyer was given a choice between the traditional screw-mount design and the conveniences offered in the new style. While retaining the basic shutter, the M3 has such added refinements as: viewfinder frame lines which automatically adjust to three different lens focal lengths, a single-stroke film advance lever rather than the wind knob, one non-rotating speed knob for all shutter speeds, and a back panel which can be opened to assist in film loading.

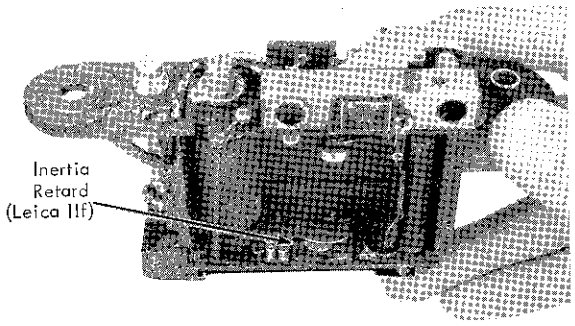


Figure 99

OTHER LEICA RANGEFINDER MODELS

Except for minor variations, the remaining screw-mount Leicas are nearly identical to the IIIf. Both of the other models in the "f" series, the IIf and the If, are merely simplified versions of the camera you have just studied. In the IIf, the slow speeds have been eliminated. In the older models, the fastest speed is 1/500 second rather than 1/1000 second (the closing curtain latch still has two eccentric studs, but only the lower one is used. Instead of an escapement, the IIf uses a simple inertia retard, Fig. 99. This retard, used only at the slowest speed (1/25 second, the full-aperture speed), is actuated in the same manner as the escapement in the IIIf.

The If, a simplified version of the IIf, has no built-in rangefinder or viewfinder. Instead, it has two accessory shoes, one of which is used to hold a detachable accessory finder.

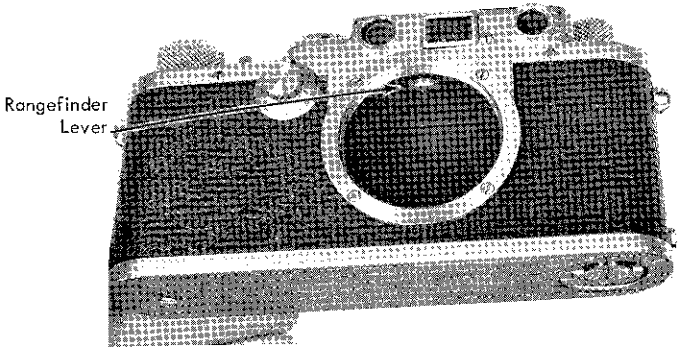
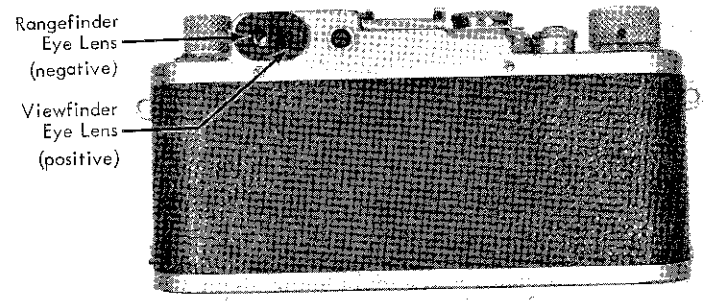


Figure 4

From the back of the camera, you can see the two eye lenses which are used for viewing and focusing. When the lens is being focused to the subject distance, the rangefinder images are viewed through the left eye lens, Fig. 5. If you look through this eye lens while actuating the rangefinder lever with your finger, you can observe the movement of the image reflected by the prism in relation to a fixed image. The second eye lens is the viewfinder, used for viewing and composing the picture.



When you load film in the camera, the baseplate must first be removed. Turn the lever lock to the "open" position, Fig. 6, and lift this end of the baseplate up from the camera body. After the baseplate has been set aside, the film take-up spool can be pulled from its friction mount on the film take-up sleeve, Fig. 7.

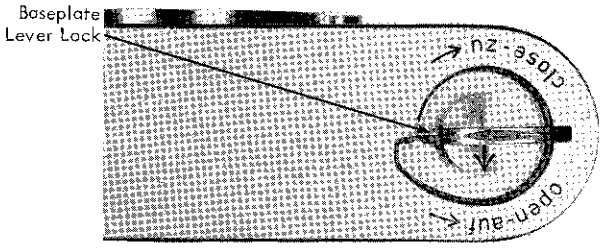


Figure 6

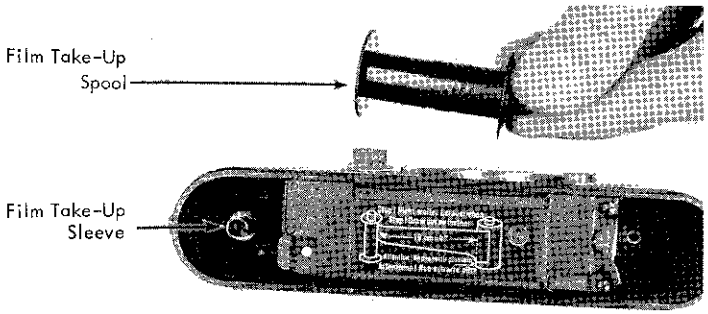


Figure 7

Before taking out the four screws that hold the lens mounting ring, note the position of the engraved locating mark on the edge of the ring, Fig. 8. Although the screw holes will align in any one of four positions, the locating mark should be to your left as you are looking at the front of the camera. This places clearance cutouts in the mounting ring (for the top cover and rangefinder arm) to the top of the camera. If shims are used under the lens mounting ring to correct the lens/film distance and/or parallelism, carefully record their positions during removal.

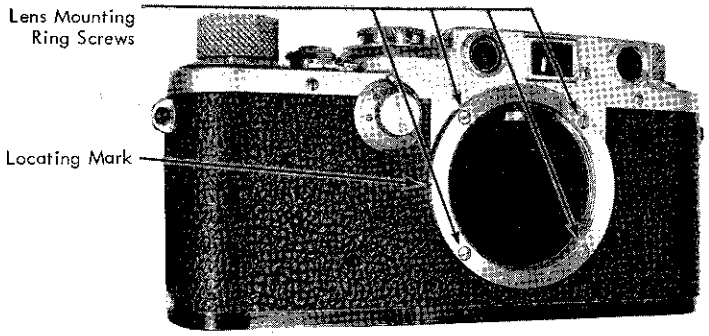


Figure 8

The shutter's now set for electronic flash. So the opening curtain should be completely across the focal-plane aperture when the trace rises. But suppose the Comparascope shows contact closure before the opening curtain reaches the end of the aperture. In that case, loosen the setscrews and rotate the contact cam slightly in a counterclockwise direction. That moves the cutout in the contact cam further away from the tail of the movable contact. And the flash fires at a later time. Or suppose the contacts close after the disengaging lever strikes the closing curtain latch. Then, the closing curtain enters the aperture before the flash fires. So you must rotate the contact cam slightly in a clockwise direction.

Once you've adjusted the contact cam for the shortest delay, check the longest delay. That's the earliest point during the opening curtain travel that the contacts close. Leave the disengaging lever at 1/25 second. And rotate the sync dial to the "20" calibration. Using the same procedure to restrain the contact cam, release the shutter and observe the trace. The trace should indicate contact closure as the opening curtain just starts to move.

You've now adjusted the contact cam at the "O" and the "20" settings. The remaining delay times should be accurate as well. You can, however, make a more exact adjustment by asking your customer what flashbulb he normally uses. Then, referring to the Leica guide charts, you can synchronize your customer's camera precisely to the flashbulb he prefers.

Here, it's best to remove the body shell. By positioning the camera over the photocell, you can adjust the Comparascope to show the entire shutter cycle -- the opening time, the full-open time, and the closing time. The shutter trace should fall within the curve for the particular flashbulb.

A set of flash curve overlay charts comes with the Comparascope. Each chart shows the flash curve produced by one particular flashbulb. The flash curve shows the time it takes for the flashbulb to reach its peak intensity and then to die out -- a curve that somewhat resembles the curve produced by a shutter. Just select the appropriate overlay chart and place it in front of the Comparascope screen. Set the Comparascope to the time indicated on the overlay chart. Now, referring to the Leica guide tables, set the shutter speed and the flash sync to correspond with the flashbulb.

Closing the flash contacts triggers the Comparascope. But the trace on the screen is that of the shutter cycle. The curve produced by the shutter should fall within the flash curve on the overlay chart. By rotating the contact cam, you can position the shutter curve until it's at the best location to use the maximum amount of light that the flashbulb puts out.

parts prior to disassembly should eliminate the need for adjusting the sync delay. Once your scribe marks are aligned, the timing between the contact cam and the disengaging lever must be the same as before. However, if you did not scribe the parts (or the contact cam was not correctly adjusted before removal), you must locate the correct position prior to installing the speed knob.

To find the approximate starting point, first set the disengaging lever at 1/25 second (the full-aperture speed on the "red dial" model) and align the sync dial with the "0" calibration. This is the proper combination of settings for electronic flash ("0" delay). With the shutter in the fully-released position, the contacts should now be closed — that is, when the opening curtain has completely crossed the focal-plane aperture. Install the contact cam over the disengaging lever so that the cutout (in the contact cam) passes over the tail of the movable contact.

Although the contacts will now close once the opening curtain has crossed the focal plane at the electronic flash settings, the adjustment is not necessarily precise. Actually, the contact cam may be rotated a few degrees in either direction with the tail of the movable contact still remaining in the cutout. This amount of rotational movement allows for exact positioning of the contact cam.

After tightening the setscrews on the contact cam, you can check the sync delay. Here, you need some type of flash-sync testing device. If the delay is either too short or too long, just loosen the setscrews. You can then turn the contact cam in one direction or the other.

The test instrument indicates when the sync contacts close in relation to the shutter operation -- in this case, with respect to the position of the opening curtain. If you're using an oscilloscope-type tester (such as the Comparascope), you can actually see the contact closure on the viewing screen.

For example, say you're using the Comparascope to check the "red dial" Leica for proper contact operation. You've already replaced the contact cam. Set the disengaging lever at 1/25 second and set the sync dial to " O ". Connect the camera to the Comparascope with a flash cord. Now, the trace on the viewing screen rises when the contacts close.

You can hold the contact cam and allow the opening curtain to move slowly across the aperture. That way, you can see the opening curtain's exact position when the contacts close. Just allow the contact cam to rotate slowly until you see the trace rise.

Next, take out the six screws that retain the body shell. Four of these screws can be seen from the front of the camera, Fig. 9, while the other two are located at the back on the top cover. Now, carefully slide the body shell downward from the camera, Fig. 10. The film pressure plate, a free-fitting part remaining with the body shell, will be loose once the two camera sections have been separated. Notice that the beveled edge of the pressure plate goes down to facilitate film loading (an important point to remember during reassembly). Lift out the pressure plate and remove the two flat springs which sit in recesses in the body shell, Fig. 11. These springs provide the tension for the pressure plate to hold the film flat against the focal plane.

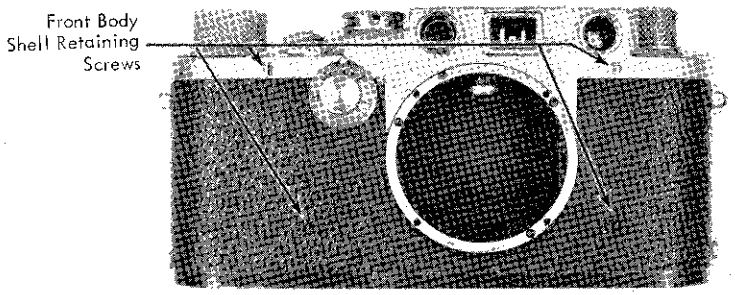


Figure 9

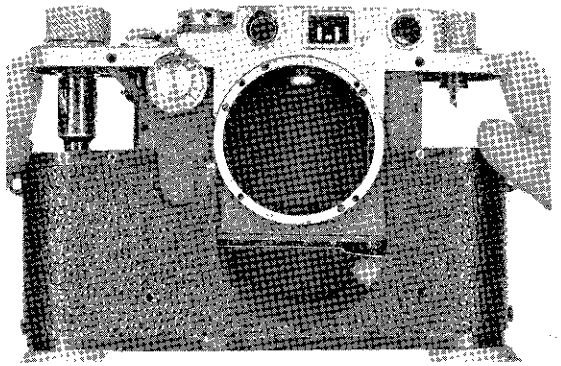


Figure 10

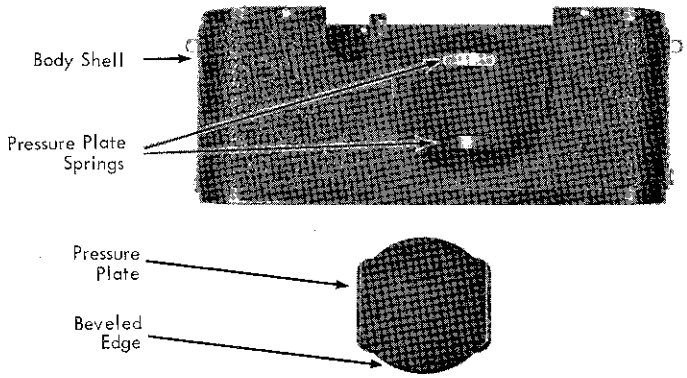


Figure 11

At this stage, you can set and release the shutter while observing the familiar actions of the film take-up sleeve, the upper gear train, the sprocket, and the first curtain wind gear, Fig. 12. As you wind the shutter, notice the pawl which engages the gear on top of the film take-up sleeve to act as the one-way clutch, Fig. 13. When the wind knob is rotated to advance the film, the pawl disengages to allow the gears to turn, Fig. 14, and then re-enters the gear teeth when pressure is relieved to prevent the curtains from pulling in the release direction.

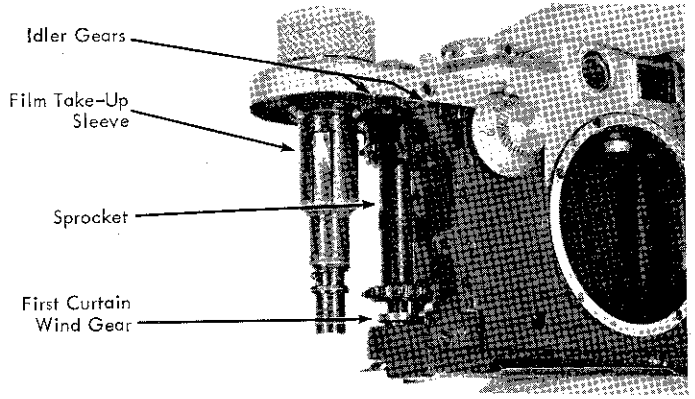


Figure 12

prior to installing the speed knob. This timing procedure will follow the rangefinder adjustment, applicable to either model, in this text.

ADJUSTING THE RANGEFINDER IN THE LEICA IIIf

As previously mentioned, the Leica rangefinder can be conveniently adjusted without removing the top cover. The two adjustment points can be reached by removing the cap screw next to the front viewfinder window and by unscrewing the bezel over the rangefinder lens in front of the movable prism. Of course, the camera lens must be in place at the taking position when testing the rangefinder.

There are two considerations in checking the superimposed rangefinder images. The first is that they must coincide when the lens is correctly focused for a particular distance. Secondly, they must be on the same plane, so that one does not appear above or below the other.

Your first adjustment is to align the images from top-to-bottom. Although this has nothing to do with the distance setting, the movable image may appear slightly higher or lower than the fixed image. If this is the case, the lens in front of the movable prism can be rotated after its bezel has been removed. Since this lens is actually a wedge prism, changing its rotational position will alter the refraction of the light rays entering the rangefinder. To make the adjustment, turn the wedge in the same direction that you want the image to move.

Next, to test the rangefinder accuracy, set the lens at infinity and view a distant target (preferably at a distance of at least 600 times the focal length of the lens). If the images of the target seen through the rangefinder eyepiece do not align — one appearing to the right or the left of the other — the prism linkage must be adjusted. After removing the cap screw at the front of the top cover, insert a small screwdriver into the access hole and turn the grub screw in one direction or the other until the images align. Once the rangefinder has been adjusted for infinity, it will be correct at the closer distance settings.

ADJUSTMENT OF THE CONTACT CAM IN THE "RED DIAL" LEICA IIIf

Since the "red dial" Leica has a separate contact cam, this part must be replaced at the proper relationship to the tail of the movable contact. This adjustment must be precise to provide the proper sync delay for a given combination of flashbulb and shutter speed.

Assuming that the contact cam was in the correct position when you received the camera, the scribe lines you placed on the

while striking the blocking plate and holding the shutter open at "time."

If you are unable to adjust the one-second exposure through the slow-speed cam, it is also possible to change the depth of pallet engagement by reforming the stop bar (see figure 62). However, this procedure would rarely (if ever) be necessary.

Note: In making these adjustments, the shutter speeds were checked before replacing the body shell. That is, it is necessary to pass light through the camera shutter to the photocell in the test instrument. Such light passage would, of course, be prevented by the body shell. If you wish to test the shutter speeds on a screw-mount Leica without removing the body shell, a special reflecting adaptor is required. The adaptor reflects the light passing through the shutter to the photocell. Such a situation might arise when a customer brings his camera into your shop and requests a report on the accuracy of the shutter speeds. If the special adaptor is used, it is then unnecessary to disassemble the camera. (In most cameras, you may gain access to the focal plane without such disassembly. Usually, the camera back may be opened or removed for film loading. The screw-mount Leicas, with their unique method of loading the film from the bottom of the camera, are exceptions.)

Now that you have adjusted the shutter speeds, you can complete your reassembly of the Leica. Set the shutter to "bulb" and remove the speed knob, wind knob, and film take-up sleeve with the counter dial parts. Before installing the top cover, resolder the sync wire to the contact plate. If you had previously removed the rangefinder and viewfinder eye lenses for cleaning purposes, these can also be replaced at this time. Next, seat the spacer washer over the rangefinder focusing disc on the rewind flange and reassemble the top cover with its components. Since the disengaging lever was previously set to "bulb," the speed knob should be installed with its "B" calibration aligned accordingly.

Replace the two flat springs and the pressure plate (with its beveled edge to the bottom) within the body shell. Now, slide the body shell onto the camera and install the retaining screws. Finally, assemble the bottom cover, the film take-up sleeve, the baseplate, and the lens mounting ring.

There are two more tests you should make at this time: the rangefinder alignment and the flash synchronization. Since the "black dial" Leica illustrated here has a one-piece contact cam and speed knob, there is no adjustment for the sync delay. However, the continuity should be checked to assure that the flash will fire properly. In models with a separate contact cam, the "red dial" Leicas, the position of the contact cam must be adjusted

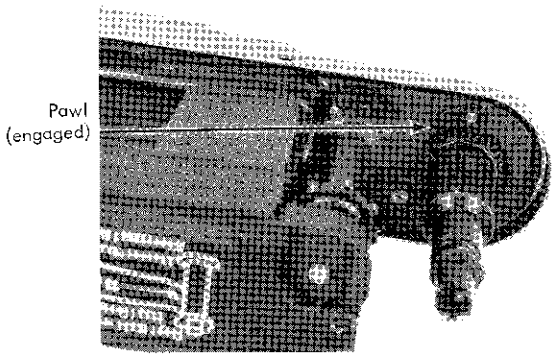


Figure 13

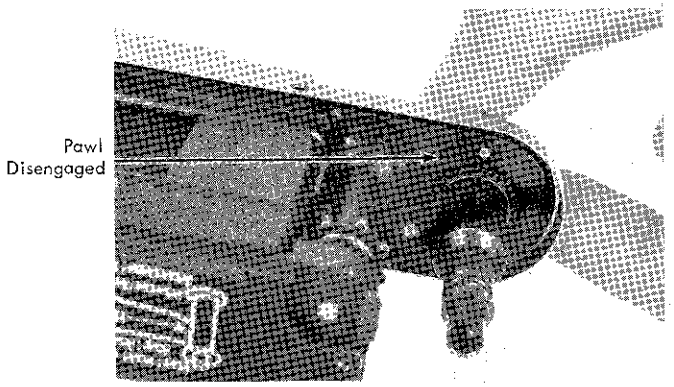


Figure 14

To remove the bottom cover, take out its three retaining screws -- two small screws at one end and a larger screw at the opposite end, Fig. 15. Now, you can see the tension-setting worms and worm gears at the ends of the take-up rollers, Fig. 16. Also locate the flat release spring, the flat retard rod spring, and the opening curtain cam. The base lock, Fig. 6, engages the base anchor plate to secure the baseplate.

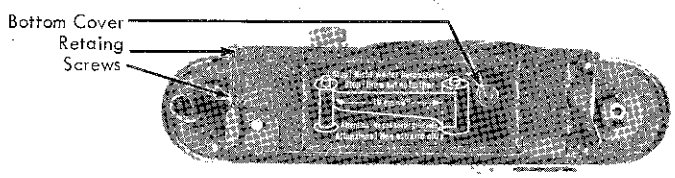


Figure 15

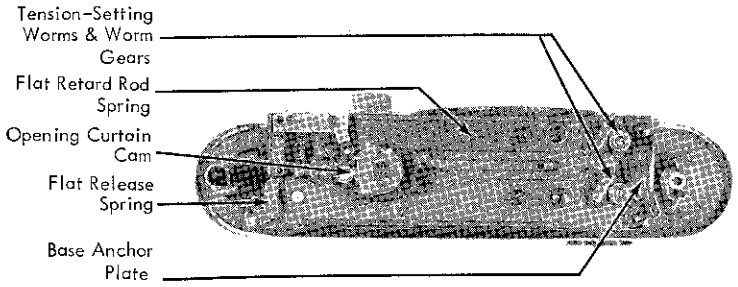


Figure 16

There are also two refinements to the basic design that may be observed at this time. One is the secondary locking pawl which latches the opening curtain cam in the "set" position. As you have seen, the curtains cannot travel against the one-way clutch while they are being wound. Once the curtains reach the "set" position, the secondary locking pawl catches a notch in the opening curtain cam, Fig. 17. This provides an additional latch to hold the curtains fully wound, a precise locking point which prevents any backlash in the one-way clutch.

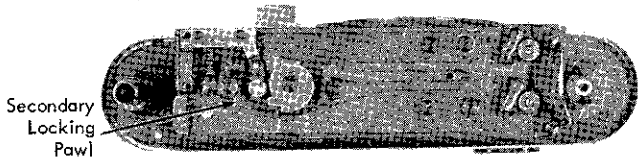


Figure 17

When the release plunger is depressed to trip the shutter, the end of the flat release spring is forced against the tail of the secondary locking pawl, Fig. 18. This pushes the secondary locking pawl out of engagement with the opening curtain cam to free the drum (just after the interlocking studs on the sprocket and the first curtain wind gear have been separated).

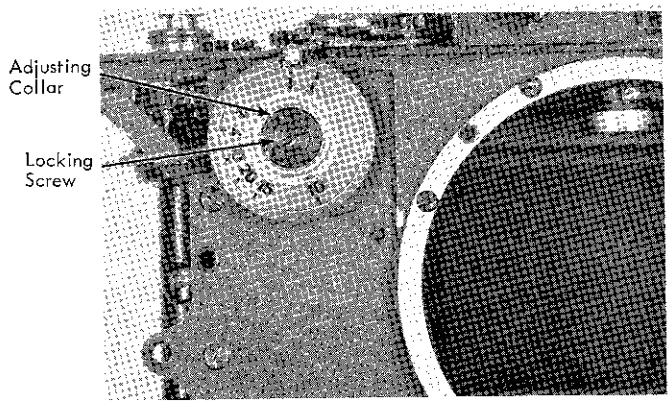


Figure 98

knob while the locking screw threads directly into the back of the slow-speed cam on the other side of the front plate. Changing the relationship between these two parts will alter the position of the slow-speed cam.

After backing off the locking screw a partial turn, the adjusting collar may be screwed in or out. Then, when the locking screw is retightened, it will move the slow-speed cam to a new position. For a slower shutter speed, the adjusting collar is turned in a clockwise direction (moving the slow-speed cam in further), while a faster exposure is obtained by turning the adjusting collar in a counterclockwise direction.

If you did alter the one-second exposure in this method, it may also be necessary to adjust the blocking plate on top of the camera body. This is because the upper retard lever has been moved in or out, changing its relationship to the blocking plate. If the upper retard lever has been moved into deeper engagement with the closing curtain cam, it may strike the blocking plate at 1/10 second and at one second, holding the shutter open. In this case, loosen the screw and slide the blocking plate toward the rear of the camera until it clears the upper retard lever at 1/10 second and at one second. If the upper retard lever engagement with the closing curtain cam is not as deep after your adjustments at the one-second setting, the shutter may not remain open on the "time" setting. Then, the blocking plate must be moved forward, allowing it to catch the upper retard lever on "time."

The difference between the upper retard lever's position at 1/10 second and at one second compared to its position at "time" is very slight. Thus, the adjustment of the blocking plate is critical. Check this action repeatedly to assure that the upper retard lever clears the blocking plate at 1/10 second and at one second,

any adjustments. To prevent damage to the shaft, you can place a metal bar beneath the closing curtain latch. This will brace the closing curtain latch in position, preventing it from moving down when the eccentric is turned.

By changing the position of the eccentric stud, you should be able to adjust the shutter speed either faster or slower than the allotted tolerance. Once the shutter speed is correct, the eccentric stud should be approximately at the mid-point of its rotational travel. If you are unable to adjust the accuracy of the shutter speed by turning the eccentric stud (the 1/500 second remaining either too slow or too fast), you must again check for a malfunction in the camera. Once the side-to-side variation has been corrected, it should not be necessary to further alter the curtain tensions.

After the 1/500 second has been adjusted, the remaining slower speeds through 1/30 second should also be within tolerance. Now, set the speed knob to 1/1000 second and test the exposure. If this speed is incorrect, change the position of the higher eccentric stud on the closing curtain latch. Use the same procedures and precautions here that you used while adjusting the lower eccentric for 1/500 second.

All of the intermediate and fast speeds should now be within tolerance. The next step is to set the speed knob at 1/30 second and the slow-speed knob at one second to test the longest shutter speed. Again, this speed will probably be correct without further adjustment. However, if the one-second exposure is not within tolerance, the slow-speed cam may be moved either in or out to change the depth that the upper retard lever engages the closing curtain cam. This adjustment is provided at the front of the slow-speed knob.

To reach the one-second adjustment point, first loosen the setscrew and unscrew the knurled cap on the front of the slow-speed knob, Fig. 97. This reveals an adjusting collar and a locking screw, Fig. 98. The adjusting collar screws into the slow-speed

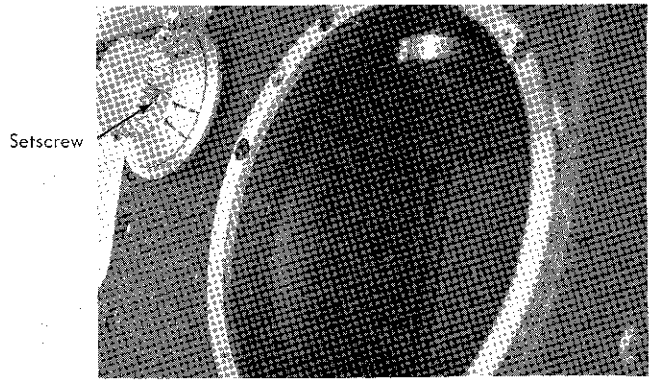


Figure 97

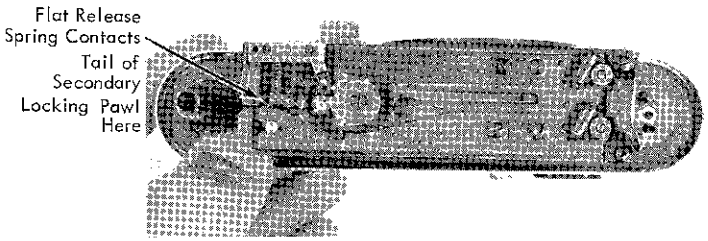


Figure 18

A second refinement was added to remedy a problem caused by the increased curtain velocity achieved through improved shutter design. In order to cut down friction and increase curtain velocity, the opening curtain drum in several Leica models runs on ball bearings. Ball-bearing races are also provided for the closing curtain cam and the first curtain wind gear. This lengthens the life of the shutter by reducing wear, but the faster-moving curtains have a tendency to bounce back into the focal-plane aperture after the exposure. To prevent curtain bounce, the Leica IIIf has a brake which arrests the opening curtain once it has traveled across the picture area.

As the opening curtain nears the end of the focal-plane aperture, the opening curtain cam strikes the brake lever, Fig. 19. This swings the brake lever aside, expanding a shoe within the curtain wind idler to stop the action. You will be able to see the individual parts of the brake after further disassembly.

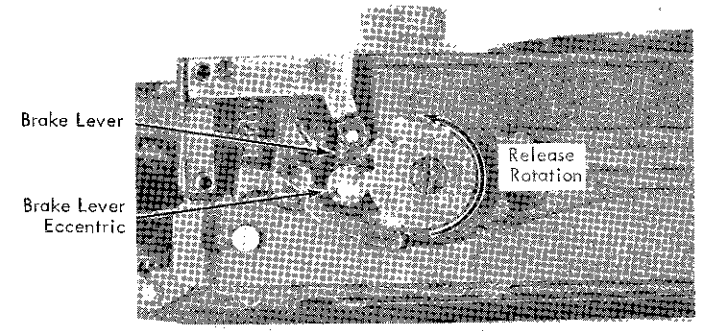


Figure 19

To regulate the amount of braking action, an eccentric nut is provided at the end of the brake lever. This eccentric can be

turned in either direction to change the point at which the opening curtain is held. However, unless it has been rotated accidentally, the eccentric should not require any adjustment. You can check the operation of the brake by holding the shutter open on "bulb" and observing the position of the opening curtain. If the eccentric on the brake lever is set correctly, the opening curtain will completely clear the picture area and will be held slightly beyond the closing side of the focal-plane aperture (the right end of the focal plane as you are viewing the camera from the front). Excessive braking action will halt the opening curtain before it has reached the end of the aperture, leaving the picture area partially covered. In fact, it is possible to brake the opening curtain so heavily that it will not travel far enough to trip the closing curtain when the disengaging lever is set at a full-aperture speed; that is, one of the speeds at which the opening curtain completes its travel before the closing curtain is released.

FLASH SYNC IN THE LEICA IIIf

We mentioned that the Leica IIIf features internal flash synchronization with a variable delay setting. In focal-plane shutters, the opening curtain (or some part that moves with the opening curtain) normally closes the sync contacts. So the opening curtain controls the length of the sync delay. The actual delay depends on when the opening curtain closes the contacts -- at the beginning of its travel, at the end of its travel, or at some midpoint in its travel.

For "X" sync, the opening curtain must completely cross the focal-plane aperture before closing the contacts. So the opening curtain uncovers the entire picture area at the moment the electronic-flash unit fires. But not with flashbulbs. Here, the contacts must close at an earlier point in the opening curtain's travel. That provides the delay which allows the flashbulb to reach its peak light output.

Different Leica models have employed various means to provide this choice of delay time. For instance, the "M" series Leicas (M1, M2, M3, and M4) have two separate flash cord sockets. The flash cord is plugged into one for electronic flash and into the other for flashbulbs.

The Leica Ig and IIIg, on the other hand, have only one flash socket. The proper synchronization is determined by the shutter speed selected. When the shutter is set at speeds from 1/60 second to 1/1000 second, the correct synchronization is automatically provided for "M" and "FP" classification flashbulbs (the

By gradually building up the tension on the opening curtain, the shutter speed at the closing side of the focal plane can be adjusted until it is within a few percentage points of that on the opening side. (Although the ANSI tolerance [ASA] allows up to 50% variation in exposure from one side to the other, it can be easily adjusted much closer through the use of proper test equipment. At the slower speeds, the side-to-side variation is lessened.) This will have the effect of slowing down the average exposure, measured at the center of the focal plane. As the opening curtain tension is increased, the slit tends to widen rather than narrow as it crosses the focal plane. This results in a slower shutter speed.

With 1 3/4 turns on the closing curtain, the 1:4 ratio will be reached once you have applied seven turns to the opening curtain. Do not exceed this amount by more than one turn — excessive tension can damage the take-up roller spring. If more than eight turns are necessary to correct the side-to-side variation, there is evidently a malfunction within the camera. This will require a thorough check to find the trouble, and possible re-cleaning and relubrication to relieve any drag on the opening curtain.

Once the side-to-side variation has been corrected, the accuracy of the shutter speeds can be tested. Adjustment points are provided for three of the speeds: 1/1000 second, 1/500 second, and one second. After these three have been corrected, the remaining shutter speeds should all be within tolerance. (The USA tolerances for focal-plane shutters are ± 25% for speeds 1/400 second and slower and ± 33% for speeds faster than 1/400 second.)

Starting with the shutter set at 1/500 second, check the average exposure with the test instrument. If the camera is operating properly and side-to-side adjustments have been satisfactorily performed, this speed will probably be well within tolerance. However, if 1/500 second is either too slow or too fast, rotate the lower of the two eccentric studs on the closing curtain latch. This has the effect of releasing the closing curtain either sooner or later, resulting in a different slit width. Turning the eccentric so that the closing curtain latch is disengaged sooner will make the slit narrower for a faster shutter speed. Conversely, moving the eccentric so the closing curtain latch will be disengaged later will result in a wider slit for a slower shutter speed. While making adjustments to the eccentric's position, continue to check the side-to-side variations as well as the average exposure at the center of the focal plane.

Note: The eccentric studs on the closing curtain latch may be extremely tight. This will require a considerable amount of downward pressure with a screwdriver in order to make

However, since you have only applied a small amount of initial tension to the opening curtain you will probably see an exposure only on the opening side of the focal plane — while the closing side remains dark or unexposed. This indicates that the closing curtain is catching up with the opening curtain at the point where the exposure ends. On the other hand, you may see no exposure at all. This indicates that the closing curtain has caught up with the opening curtain before the curtains enter the focal-plane aperture. In either case, the opening curtain is not traveling fast enough and will require additional tension.

If this is the situation, add 1/2 turn of tension to the opening curtain take-up roller and recheck to see if there is now an exposure at the closing side. If not, continue adding tension to the opening curtain by 1/2 turn increments until even exposure is visible across the entire focal-plane aperture.

This is the extent of the visual adjustments you can make on the curtain tensions. You now know that there is a slit all the way across the focal plane at 1/500 second. However, to find if the exposure is accurate and equal at both sides, an electronic shutter speed test instrument is required.

With the shutter still set at 1/500 second, check the exposure at the opening side of the focal plane with the electronic tester. This is done by positioning the camera so that the slit in the mask is under the left-hand side of the focal-plane aperture (as seen from the front of the camera). Upon tripping the shutter, make a mental note of the shutter speed delivered. Next, move the camera so that the mask slit is beneath the closing side of the focal plane and test the exposure. Do not be concerned about the accuracy of the shutter speed at this time — your first adjustments will be to correct the side-to-side variation so that the exposure on the closing side is the same as that on the opening side, even though both may be slower or faster than 1/500 second.

Side-to-side variations are also adjusted on the opening curtain take-up roller. Normally, the exposure at this point will be faster on the closing side than at the opening side. This indicates that the slit is still narrowing as it crosses the focal plane. Consequently, more tension must be added to the opening curtain to increase its velocity. Rather than 1/2 turn increments, however, you should now test the opening and closing sides after each 1/4 turn added to the opening curtain.

Whenever the tension is changed, operate the shutter two or three times before again checking the results on the tester. This allows the take-up roller spring to settle into its correct position.

contacts are closed 20 milliseconds before the closing curtain begins its travel). For electronic flash, the speed knob is turned to one of its engraved arrows (the black arrow indicating 1/50 second and the red arrow indicating 1/30 second). The contacts are then closed when the opening curtain has completely traversed the focal-plane aperture for "X" sync.

As the first of the internally synchronized Leica models, the IIIf (as well as the If and IIf) also has only one flash cord socket. The photographer must set the delay time according to the shutter speed and the type of flash he is using. The shutter speed, however, still limits the type of flash that may be used. That is, "FP" bulbs (and certain other large flashbulbs) can be used at all speeds up to 1/1000 second. Smaller flashbulbs (with a shorter light peak duration) and electronic flash can only be synchronized at speeds of 1/50 second or slower.

From the top of the camera, locate the sync dial beneath the speed knob, Fig. 20. Each calibration around the sync dial corresponds to a Leica reference number for a specified delay time (not to the actual number of milliseconds). When the sync dial is moved to different settings, it changes the time at which the flash contacts are closed during the travel of the opening curtain.

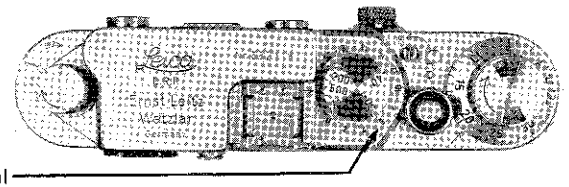


Figure 20

Correct sync delay settings for various shutter speed/flash combinations may be found in Leica reference tables. (See the tables in the back of this book.)

There are two variations of the Leica IIIf which can be distinguished by the color of the calibrations around the sync dial: the "red dial" Leica and the "black dial" Leica. Since the two models have different speed ranges, separate sync calibrations are used. The speed range in the "black dial" Leica is: slow speeds, "time," "bulb," 1/30 second, 1/40 second, 1/60 second, 1/100 second, 1/200 second, 1/500 second, and 1/1000 second. The speed range in the "red dial" Leica is: slow speeds, "time," "bulb," 1/25 second, 1/50 second, 1/75 second, 1/100 second, 1/200 second, 1/500 second, and 1/1000 second. The model illustrated in this text is the "black dial" Leica.

To examine the sync contacts, the speed knob must first be removed. The speed knob is secured to the disengaging lever by three setscrews which are accessible through clearance holes. Lift up the speed knob in the normal manner used for setting shutter speeds. While the speed knob is held in this position, Fig. 21, insert a small screwdriver through the clearance holes and loosen (but do not remove) each setscrew in turn. Now, lift the speed knob straight up from the disengaging lever.

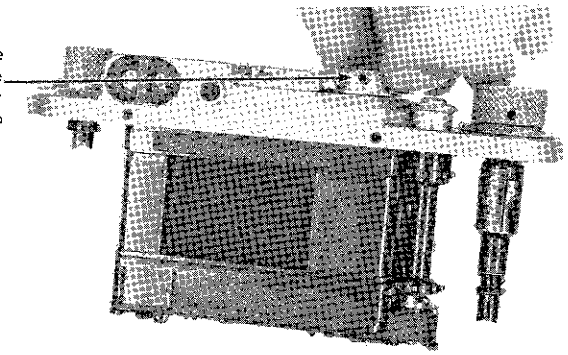


Figure 21

Both sync contacts are attached to the inner circumference of the sync dial, Fig. 22. Notice that the innermost contact is movable, a light spring forcing it against the fixed contact. In the position shown in figure 22, the circuit would be closed because the two contacts are engaged. Until the precise moment that the flash is to be ignited, however, the contacts must be held apart, against the tension of the light spring, Fig. 23. This is the function of the contact cam which is cut in the shaft of the speed knob.

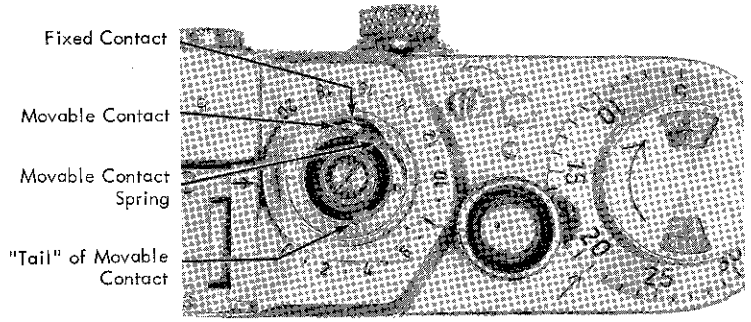


Figure 22

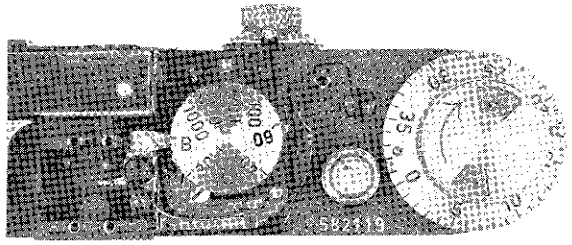


Figure 96

Since you previously applied 1 3/4 turns of initial tension to the closing curtain and three turns to the opening curtain, the shutter should now operate properly on "bulb." If this action appears visually correct, set the speed knob to 1/30 second and trip the shutter to see if the opening curtain has enough tension to disengage the closing curtain latch. Should the closing curtain fail to release at 1/30 second, increase the initial tension on the opening curtain take-up roller by 1/2 turn increments (by turning the slotted end of its tension-setting worm clockwise). Recheck the operation after each adjustment.

As mentioned earlier, once the initial tension on the closing curtain has been set at 1 3/4 turns, further adjustment here should not be necessary. If the closing curtain fails to properly travel across the focal plane on "bulb," there is most likely a malfunction in the camera. In such an event, check to see if the curtain is dragging against a light shield or other shutter part. If there is no apparent mechanical malfunction, reclean and relubricate the shutter.

When the shutter operation appears visually correct at "bulb" and at 1/30 second, the next step is to set the speed knob at 1/500 second and observe the slit as it crosses the focal plane. This can be done by releasing the shutter while holding the camera toward any light source (the camera should be held approximately at arms length away from your eye). If the slit is traveling all the way across the focal plane, you will momentarily see an exposure of the light source through the entire focal-plane aperture. Even though the slit is exposing only a small portion of the focal plane at a time as it travels across the aperture, the eye sees it as one complete exposure of the entire aperture.

(Note: The terms "opening side" and "closing side" are used frequently when discussing focal-plane shutters. The opening side refers to the end of the focal-plane aperture from which the curtains begin their movement when the shutter is released. The closing side is the opposite end of the focal-plane aperture.)

When setting up the tensions in the Leica IIIf, the closing curtain tension is first set at a fixed amount. Once established, the closing curtain tension is not changed during the remaining adjustments. The tension on the opening curtain (and thereby the velocity) is then increased by gradual increments until the exposure indicated on the closing side of the focal plane is the same as that on the opening side. That is, once you have set the closing curtain tension the side-to-side adjustments all will be made on the opening curtain. This will increase the speed of the opening curtain with respect to the closing curtain, causing the slit to widen (rather than narrow) as it crosses the focal plane.

When the two curtains are properly adjusted in the Leica IIIf, the ratio between the closing curtain tension and the opening curtain tension will be around 1:4. This means that there will be approximately four turns of tension on the opening curtain to every one turn of tension on the closing curtain. If it is necessary to exceed this ratio while correcting the side-to-side variation, there is evidently a malfunction in the camera that is binding the opening curtain. Similarly, if it is necessary to go beyond your initial tension setting on the closing curtain before it will properly travel across the focal plane, a camera malfunction is once again indicated.

To precisely control your adjustment procedure, keep a record of the turns of initial tension applied to each take-up roller. All of your initial tension adjustments will be made with the curtains in the released position.

For convenience in operating the shutter, temporarily replace the film take-up sleeve, the counter dial with the slotted counter gear, and the wind knob. Also, seat the disengaging lever at the "bulb" position and install the speed knob with its "B" calibration aligned at the normal index location, Fig. 96. (When timing models with a separate contact cam, replace this part first and then the speed knob — since these parts rotate with the opening curtain drum, the additional weight will affect the shutter speed delivered. For this reason, you should always test and adjust the shutter speeds with the speed knob and contact cam in place.)

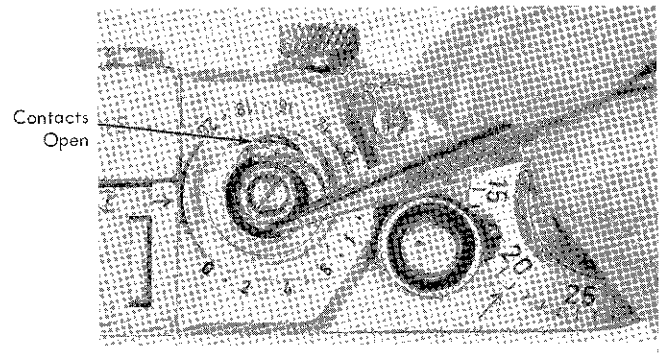


Figure 23

Turn over the speed knob to examine the contact cam, Fig. 24. Since the speed knob attaches to the disengaging lever, it rotates with the opening curtain drum. During this travel, the tail of the movable contact rides against the outer edge of the contact cam. So the contact cam holds the movable contact against its spring tension to keep the circuit open. When the opening curtain reaches the proper point in its travel, the tail of the movable contact drops into the contact-cam cutout. The light spring then forces the movable contact against the fixed contact. That completes the circuit to fire the flash.

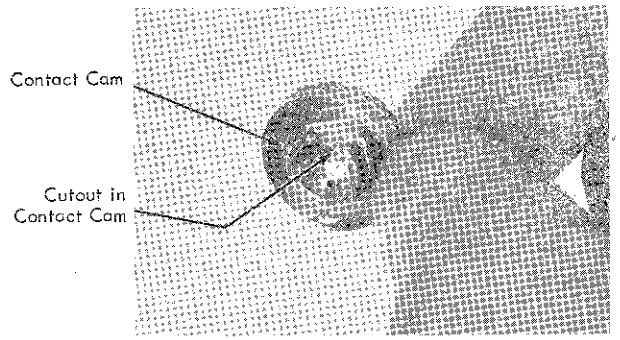


Figure 24

When the speed knob is rotated to select a different shutter speed, the position of the cutout in the contact cam is changed in relation to the tail of the movable contact. Consequently, the flash will be fired at a different time during the travel of the opening curtain. Because the contact cam is part of the speed knob, the resulting delay time will be altered whenever the shutter speed is changed.

The relationship between the movable contact tail and the contact cam cutout may also be varied by turning the sync dial to another calibrated setting. As the sync dial is rotated, the permanently attached contacts are moved to a new position. Thus, there are two ways in which the actual delay may be altered: by moving the sync dial or by changing the shutter speed. In either case, the relationship between the movable contact tail and the contact cam cutout is affected.

> In "red dial" IIIf models, the contact cam and the speed knob are separate units. The contact cam is held to the disengaging lever by three setscrews on its outer circumference, and the speed knob is secured to the contact cam by three setscrews. Once assembled, the two parts operate as one unit, exactly as in the "black dial" models. However, because the two parts are not "keyed" together, there is a timing consideration during reassembly. When servicing one of these models, first remove the speed knob by loosening its three setscrews. Then, before taking off the contact cam, scribe a line across it and the top of the disengaging lever. During reassembly, align your scribe marks to assure the proper timing between the contact cam and the disengaging lever.

When the shutter is cocked, the contact cam must rotate with the opening curtain drum in the winding direction. It would seem that this would close the flash circuit and fire the flash during the setting stroke. To prevent such a premature flash ignition, a safety switch is used under the closing curtain latch (which you will see after the top cover has been removed). Until the release plunger is depressed, the safety switch is open to break the circuit. Then, when the shutter is tripped, the closing curtain latch is allowed to drop down and close the safety switch. As a result, the circuit will be completed when the tail of the movable contact drops into the cutout in the contact cam.

For example, consider that the shutter is in the released position and the correct relationship between the contact cam and the movable contact has been set, Fig. 25. As the shutter is wound, the tail of the movable contact momentarily drops into the cutout in the contact cam, Fig. 26. However, the flash is not fired because the safety switch is open, breaking the circuit. When the shutter is fully wound and then released, the closing curtain latch drops down and closes the safety switch, Fig. 27. The contact cam simultaneously begins its rotation, moving with the opening curtain drum. As soon as the cutout in the contact cam reaches the tail of the movable contact, Fig. 28, the flash is ignited.

The screw at the bottom of the front plate (which is slightly shorter in length than the other four front plate screws) and the uppermost screw around the lens opening both pass into anchor plates on the inside of the focal plane. Before installing these two, loosen the screws which secure the anchor plates (one at the end of the flat retard rod spring and two within the accessory shoe cavity). Now, align the threaded holes in the anchor plates with their corresponding holes in the front plate and replace the two front plate screws. Tighten down the anchor plates once again and install the remaining three screws around the lens opening which thread into the light shields.

TIMING THE SHUTTER SPEEDS IN THE LEICA IIIf

At this stage of assembly you are ready to begin with the setting of the curtain tensions and adjustment of the shutter speeds. Unless a systematic procedure is followed to make these adjustments, the process can become unnecessarily complicated. It is therefore essential that you perform the procedure precisely in the order presented.

Some of the preliminary adjustments will involve tension setting steps that will be checked strictly by visual observation. However, once these visual checks have been completed, the remainder of the adjustments will require the accuracy of an electronic tester.

When you're testing a focal - plane shutter with the Comparascope, first place the mask with a fine slit over the photocell. Then, position the camera over the photocell (and mask) so that the curtain slit is parallel to the mask slit. The tester triggers when the slit between the curtains passes over the slit in the mask. That way, the tester measures the effective exposure at only one area of the focal plane -- the area under which you've positioned the slit in the mask. You can then move the camera to bring a different section of the focal plane above the mask slit. That way, you can measure the shutter speed at any part of the curtain operation. That's necessary to assure that the exposure's uniform across the entire film area.

You will recall that the opening curtain always requires more initial tension than the closing curtain. This is because the opening curtain must operate additional shutter parts during its travel (including the curtain wind idler, the first curtain wind gear, the brake, and the disengaging lever which must release the closing curtain). If both tensions were the same, the closing curtain would overtake the opening curtain as the two crossed the focal plane. Consequently, the slit would narrow during this travel, causing the exposure on the closing side of the focal plane to be less than that on the opening side.

reassembly. A minute particle of dirt on one of the optical elements may be immediately apparent when the camera is used.

Replace the rangefinder viewing prism with its slotted end facing the rear of the camera, Fig. 95. Next, install the spring washer and cover plate over the viewing prism.

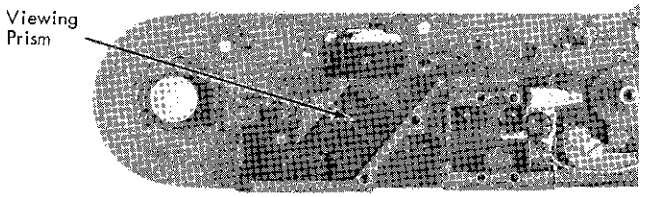


Figure 95

Be sure to seat the prism mask in front of the viewing prism before replacing the rangefinder assembly. As you seat the rangefinder assembly in position, slip the screw head on the underside of the eyepiece tube into the oblong cutout in the intermediary lever. Replace the three screws holding the rangefinder assembly and install the rangefinder lever with its washer and screw. Fit the rangefinder focusing disc over the rewind flange with its finger in the forked section of the intermediate lever.

Before replacing the speed control plate, examine the screw hole which passes through its collar. Notice that the screw hole is threaded on one side of the collar and is recessed for the screw head on the other side. With the shutter in the cocked position, the recessed end of the screw hole will be toward the front of the camera. Seat the washer and the speed control plate (with its collar up) over the opening curtain drum shaft. Align the screw hole in the speed control plate with the hole through the opening curtain drum shaft and insert the screw from the recessed end. Tighten the screw securely. Now, install the disengaging lever with its compression spring and central screw.

To replace the front plate, first install the light shield over the escapement. As previously noted, the upturned edge of this light shield passes between the focal-plane light shield and the take-up rollers. Now, slide the curtain drum light shield into place to the inside (toward the center of the camera) of the upturned edge on the other end of the escapement light shield.

While seating the front plate, work through its access hole to hook the cam follower behind the upturned tab on the pallet lever. Once the front plate is properly positioned, replace four of its retaining screws — two at each side.

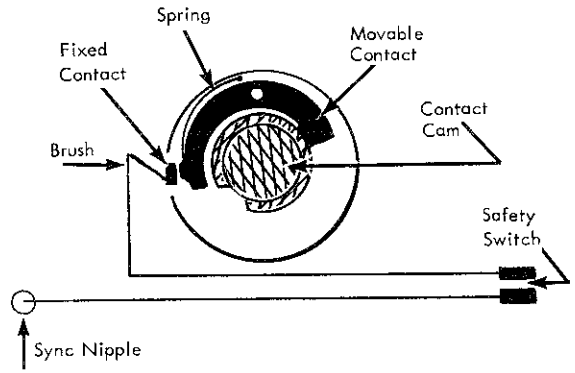


Figure 25

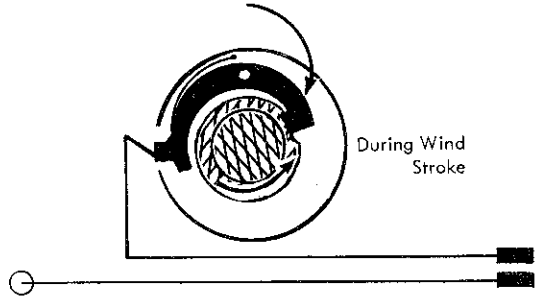


Figure 26

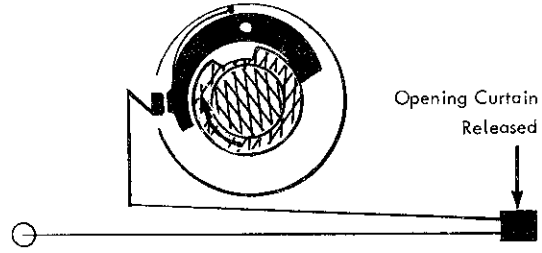


Figure 27

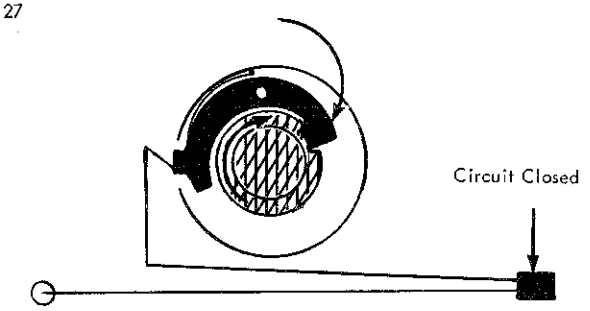


Figure 28

To proceed with the top cover disassembly, locate the clearance hole on the outer circumference of the wind knob, Fig. 29. Through this hole, you can see the setscrew which holds the threaded wind knob to the top of the film take-up sleeve. (It may be necessary to lift and rotate the film reminder dial around the wind knob until the setscrew is visible through the hole.) Using a small screwdriver, loosen — but do not remove — this setscrew (about two turns should be sufficient). Now, unscrew the wind knob in a counterclockwise direction.

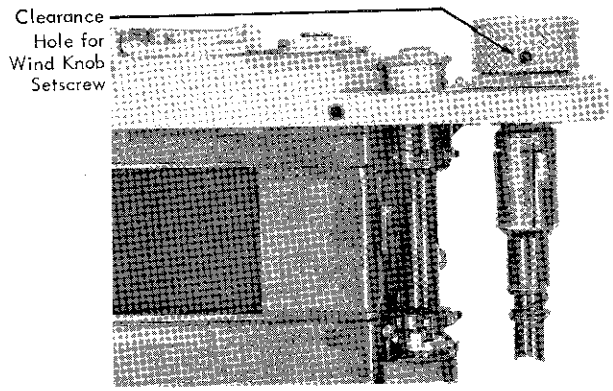


Figure 29

Once the wind knob has been removed, the film take-up sleeve and counter dial parts will be free. If you temporarily hold the film take-up sleeve in place, Fig. 30, you can observe the operation of the counter dial.

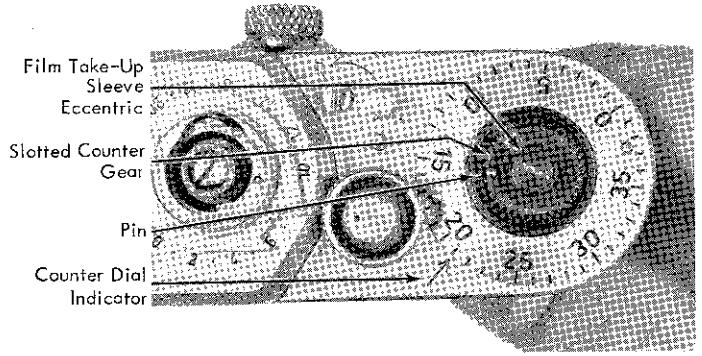


Figure 30

does not move far enough to release the opening curtain cam, loosen the two screws holding the flat release spring. This will allow you to slide the flat release spring toward or away from the tail of the secondary locking pawl until the tripping action is correct. Of course, since the closing curtain latch has not yet been installed, the two curtains will cross the focal plane in unison.

Loosen the secondary locking pawl screw just enough to place a drop of shutter oil on its shoulder. The rest of the bottom plate parts will be lubricated with moly-lube. The lubrication points are: the "ramp" of the flat retard rod spring which is contacted by the pin on the underside of the opening curtain cam; the point where the flat release spring contacts the secondary locking pawl; the hooked end of the secondary locking pawl which latches the opening curtain cam; and the outer circumference of the opening curtain cam which contacts the brake lever.

Next, seat the retard rod in its bearing on the bottom plate with the lower retard lever straddling the pin on the escapement first gear segment. Replace the retard rod retaining bridge with its notched nut — the longer shoulder and tapered flange of this nut go down, Fig. 94. Seat the upper retard lever spring in position over the notched nut and tighten the brass nut over the spring. When properly installed, the upper retard lever spring will tend to force the retard rod toward the front of the camera.

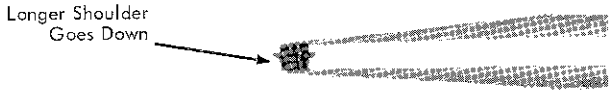


Figure 94

Using moly-lube, lubricate the upper retard lever at its point of contact with the closing curtain cam. Lubricate the upper bearing for the shaft of the closing curtain latch with shutter oil. Now, replace the closing curtain latch and its spring. Before engaging the spring, apply moly-lube to its hooking post on the closing curtain latch.

Install the upper anchor plate, the cleat which holds the top end of the focal-plane light shield, and the two screws which pass through from the accessory shoe cavity. Note that the cleat is positioned with its downward-projecting tab to the front of the camera.

Thoroughly clean the view/rangefinder components before

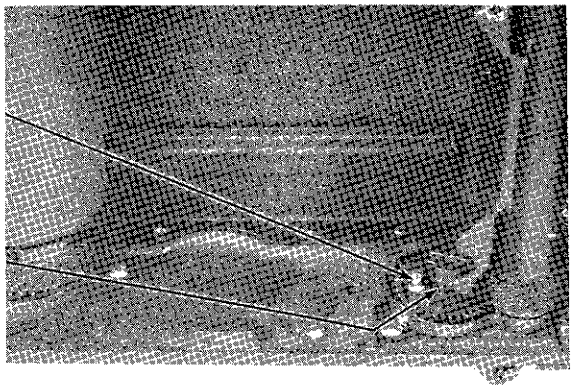


Figure 93

You can now reassemble the remaining parts on the bottom plate. These are:

1. The escapement (make sure the pallet lever is alongside, not over the top, of the pin on the pallet control gear).
2. The transfer pin and L-shaped spring which hold the release slide toward top of the camera.
3. The flat retard rod spring (with its end screw passing into the lower anchor plate and its other screw threading into the bottom plate of the escapement).
4. The secondary locking pawl with its compression spring.
5. The brake lever and its bridge (slipping the flatted end of the brake lever shaft into the open section of the brake shoe — it may be necessary to turn the brake shoe slightly with a screwdriver until its open end can be seen through the hole).
6. The small screw which only threads into the focal-plane light shield.
7. The flat release spring (with its two screws passing into the light shield and the cleat inside the focal plane).
8. The opening curtain cam with its washer (in position to latch with the secondary locking pawl when the shutter is wound).

You can now wind the curtains (by rotating the sprocket) and test the tripping action. When the release plunger is depressed, the flat release spring should force the secondary locking pawl out of engagement with the opening curtain cam after the interlocking studs have cleared one another. If the secondary locking pawl

Notice that the top portion of the film take-up sleeve — just below the threads for the wind knob — is an eccentric shaft. This eccentric shaft passes through the center of the slotted counter gear which meshes loosely with the teeth on the inner circumference of the counter dial. A slot in this gear seats over a fixed pin on the top of the camera body. This pin permits the gear to slide back and forth along its slot, but prevents rotational movement.

When the film take-up sleeve is turned to advance the film, the eccentric shaft rotates within the center of the slotted counter gear. The gear is prevented from turning with the film take-up sleeve by the fixed pin. Instead, it is moved back and forth by the eccentric, shifting only slightly in its rotational position. This is possible because of the play between the teeth of the slotted counter gear and the teeth inside the counter dial. Consequently, as this gear slides within the counter dial, the teeth disengage on one side. Then, when the slotted counter gear moves back, it is shifted enough by the eccentric to pick up the adjacent tooth on the counter dial. This advances the counter dial by one gear tooth — the equivalent of one film frame number calibration opposite the indicator on the top cover.

A one-way clutch built into the counter dial allows you to turn the dial in one direction to the "0" setting after inserting a new roll of film. Then, when the film is advanced, the counter dial is turned positively in the opposite direction by the slotted counter gear. In reassembling these parts, the counter dial may be placed over the slotted counter gear in any position.

You can now lift off the counter dial and slotted counter gear and lower the film take-up sleeve from the camera. Once removed, the film take-up sleeve may be examined more closely. Notice the circular spring which slips onto the film take-up sleeve just above the gear, Fig. 31. On reassembly, this spring fits into the notch in the pawl, Fig. 32. When the film take-up sleeve is rotated to advance the film, the spring pulls the pawl out of engagement with the gear teeth. However, if the film take-up sleeve is turned in the opposite direction, the spring forces the pawl into engagement and acts as a one-way clutch.

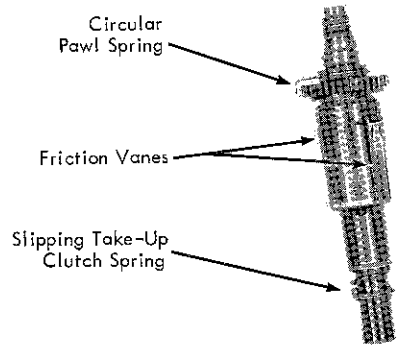


Figure 31

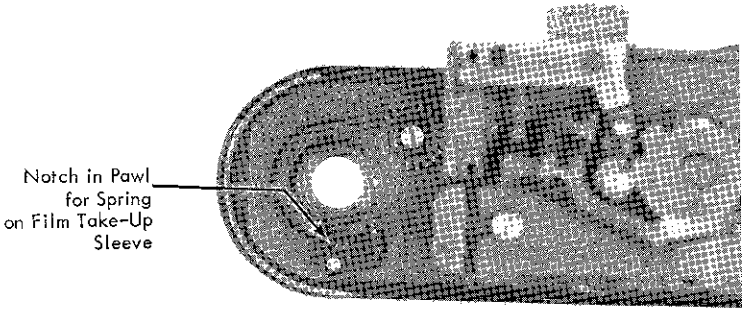


Figure 32

Three friction vanes on the outer circumference of the film take-up sleeve hold the film take-up spool in place. As you have seen, when the wind knob is turned the film is wrapped around this spool. Consequently, the effective diameter of the film take-up spool increases as more film is wound. Since the wind knob turns the same amount each time the film is advanced to the next frame, the film take-up sleeve must compensate for the increasing diameter. This is done through a slipping clutch within the film take-up sleeve itself.

Notice that the central shell of the film take-up sleeve (the section which carries the film take-up spool) is a separate piece which can turn around the shaft. A heavy compression spring on the bottom of the film take-up sleeve maintains the correct amount of tension between the two sections. As the film is wound, the central shell may slip to compensate for the increasing diameter of the film on the film take-up spool. The greater the diameter, the more the shell must slip in order to wind on the same amount of film. Some similar type of slipping take-up clutch is found on

Since the amount of initial tension is very critical, you must be precise in your adjustments. Whenever tension is applied, carefully note the amount the worm gear has rotated. When the worm gear has turned 360°, you have added one full turn of initial tension to the take-up roller spring. (You may find this easier to do if you scribe a mark on the worm gear which aligns with a convenient reference on the bottom plate when the take-up roller is at its starting point.)

As you insert each tension-setting worm into its casing, the worm gear may be forced to turn in one direction or the other. Therefore, while installing the worms carefully watch the rotations of the worm gears. After the worms are fully seated, turn each one with a screwdriver until its worm gear has returned to the previously established starting point.

Lock the tension-setting worms in their casings with the E-rings. Start each E-ring straight over the end of the tension-setting worm with its open end facing the camera's bottom plate. The worms will not have to be removed for further take-up roller tensioning.

With both take-up rollers at their starting points, you are now ready to apply the initial tension. Starting with the opening curtain take-up roller, turn its tension-setting worm clockwise with a screwdriver until the worm gear has revolved three full turns.

Use the same procedure to apply the initial tension to the closing curtain take-up roller. However, rather than three turns, put only 1 3/4 turns on this spring. As you will discover during your study of the timing adjustments, the tension of the closing curtain take-up roller will not be changed after the 1 3/4 turns have been applied — all of the tension adjustments beyond this stage will be made on the opening curtain take-up roller.

To replace the pallet control gear, mesh it with the closing curtain take-up roller gear so that the vertical pin is nearest the escapement when the shutter is released (the pin will be at a 9 o'clock position, Fig. 93). Before tightening the pallet control gear retaining screw, lubricate its shoulder with shutter oil. Also, use shutter oil to lubricate the bearings in the bottom plate which receive the retard rod and closing curtain latch.

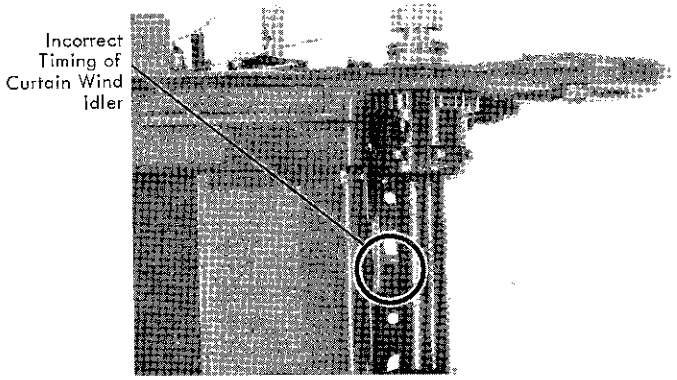


Figure 92

To test the timing, hold the release plunger up with your finger and rotate the sprocket to wind the curtains. If at the end of the wind stroke the screw is in the position shown in figure 92, loosen the two screws holding the base anchor plate and remove the bottom plate screw from the front of the camera. Now, pull the bottom plate down far enough to disengage the curtain wind idler from the first curtain wind gear. Rotate the first curtain wind gear a partial turn to change its timing and remesh it with the curtain wind idler.

When you are certain that the curtains are correctly positioned, replace the worm gears. At this point, a minimum amount of tension will be applied to the take-up roller springs. Although the tension will have to be further adjusted to correct the shutter speeds (a procedure which will be described later in the text), a minimum number of turns now will allow you to operate the camera and complete the reassembly.

First, make sure that the worm gears are snugly tightened on the ends of the take-up rollers. To do this, hold the central shaft of each take-up roller stationary with a screwdriver and tighten the worm gears in a counterclockwise direction.

Your next step is to find a starting point from which initial curtain tension adjustments will be made. Insert a screwdriver into the slot at the end of one take-up roller and rotate the central shaft in a counterclockwise direction to apply the tension. When the curtain has reached the fully-released position (with its bar at the right end of the focal plane when the camera is viewed from the front) and all of the slack has been removed, allow the spring to slowly unwind in a clockwise direction. Once the tension has been completely let off the spring, you have found the starting point; that is, the point at which there is no tension on the spring and the slack is removed from the curtain and tapes. Find the starting point for the other take-up roller in the same manner.

most roll-film cameras in which the wind knob or lever is advanced the same amount for each frame. You will see other designs in a later lesson.

If necessary, the film take-up sleeve may be taken apart after removal of the E-ring at the bottom of the clutch spring. In this event, record the positions of the washers so that they can be properly replaced. However, disassembly of the film take-up sleeve is rarely required — the unit may be cleaned intact after it has been removed from the camera.

As you continue with the Leica disassembly, you will encounter several more spacer washers. Since these may vary in different cameras, note the position of each washer as it is removed. Now, unscrew the knurled shield around the release plunger, Fig. 33. Next, set the advance/rewind lever to the "A" calibration and remove its retaining screw. Lift off the advance/rewind lever and the bushing around the advance/rewind shaft.

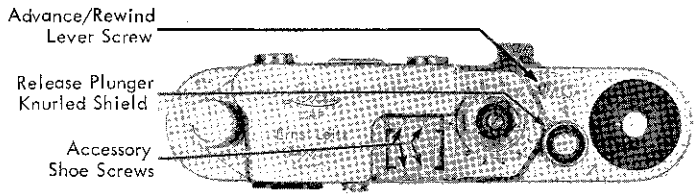


Figure 33

To remove the rewind knob, first lift it to its highest position, Fig. 34. This reveals a collar with a setscrew. The setscrew keys into a slot in the shaft beneath the rewind knob, preventing the knob and shaft from being lifted free of the camera. After you have taken out the setscrew, the rewind knob and shaft can be pulled straight up, while the lower "forked" shaft can be pushed out toward the bottom of the camera. Notice the positions of the compression spring and washer on the forked shaft (the part which normally engages the film spool within the cassette).

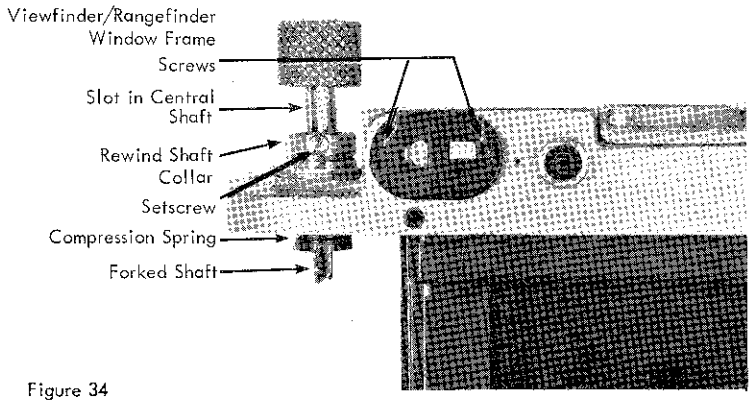


Figure 34

Both the accessory shoe and the viewfinder/rangefinder window frame can be removed after taking out their respective retaining screws (figures 33 and 34).

A notched retaining ring holds the rangefinder focus lever which pivots beneath the rewind knob position, Fig. 35. The purpose of this lever is to enable the photographer to adjust the focus of the superimposed rangefinder images according to the subject distance and his own eyesight. Shifting the rangefinder focus lever slides a lens back and forth within the rangefinder eyepiece, as you will see later. Using your spanner wrench, unscrew the retaining ring and lift out the rangefinder focus lever. On reassembly, be sure that the pin on the underside of the lever passes into the hole in the brass rangefinder focusing disc now visible beneath the top cover — this is the coupling between the rangefinder focus lever and the optical element within the rangefinder eyepiece.

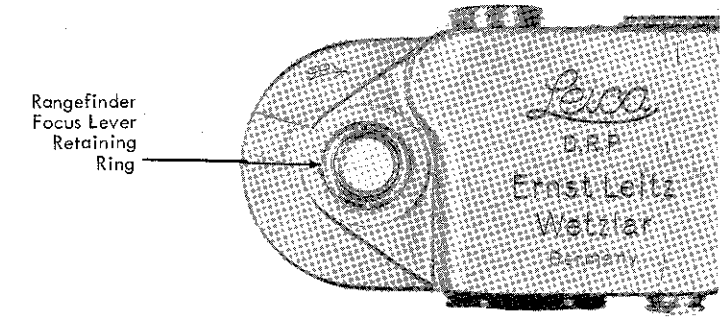


Figure 35

Rolling up the curtains as necessary, install the two take-up rollers in their bearings in the top of the camera body. Before replacing the bottom plate, be certain that the curtains and tapes are properly positioned. Then seat the focal-plane light shield in place.

Installing the bottom plate can be a tricky operation — particularly in models with a ball race for the opening curtain drum. If the ball race is present, first lubricate the individual balls with shutter oil and seat them around the track on the bottom plate. Since the oil will hold the balls in place, you can now manipulate the bottom plate. (You may find this easier to do by seating the oiled balls around the washer on the bottom of the opening curtain drum shaft — then the camera can be placed on the workbench with the lower ends of the drums and take-up rollers up, slipping the bottom plate over the top.) Whether or not the ball race is present, the bushing for the opening curtain drum shaft should be lubricated with shutter oil.

Carefully slip the bottom plate over the end of the opening curtain drum shaft. Now, hold the bottom plate in position while working the take-up rollers and the sprocket into their respective holes. Once the bottom plate is fully seated, replace the base anchor plate with its two screws at the take-up rollers end and install the short retaining screw which passes through from the front of the camera.

At this point, the opening curtain drum should rotate freely within its limits, assuring that the stop pin on the bottom plate is properly located within the slot around the lower end of the drum. You can now apply a slight amount of tension to the take-up rollers to eliminate the slack in the curtains and tapes. This can be accomplished by rotating the slotted end of the take-up roller shafts counterclockwise until slack is removed. Then, allow the shafts to slowly return to their untensioned positions.

Unless the Leica has a delayed-action mechanism, there is no special timing procedure for the curtain wind idler and the first curtain wind gear. However, it is remotely possible that these two parts could accidentally be timed in such a way that the shutter cannot be properly released. That is, when the shutter is cocked the long screw passing through the release plunger and the center of the sprocket may come to rest directly over a horizontal lug on the release slide, Fig. 92. This would interfere with the release plunger when it is depressed to trip the shutter.

ing parts. We'll also cover the timing of the shutter curtains (assuming that if you have disassembled the camera this far, you have access to an electronic-testing device).

First, if the closing curtain cam and/or sprocket assembly were taken apart, reassemble these units and lubricate their ball races with shutter oil. Normally, even if the curtains had been removed, these parts would be left in place and flush-cleaned. Then, an oiler can be inserted into the bearings to lubricate the balls. Also apply shutter oil around the inner circumference of the closing curtain cam. (A hypodermic oiler, a conventional watch oiler, and the tip of a small screwdriver are convenient tools for reaching into tight places to deposit the oil.) If you removed the upper gear train idler gears, replace these parts and lubricate their pivot shafts with shutter oil.

Although the curtain wind idler was disassembled for academic purposes, this also would normally be left in place. However, since the gear spins with the opening curtain drum, its shaft should be lubricated with shutter oil. To reach the shaft without removing the curtain wind idler, back off the retaining screw until you can place a drop of oil around the edge of the shaft. Avoid getting any oil on the brake itself -- the shoe and the drum should be perfectly dry. (Also, replace the cover plate and screw over the curtain wind idler if these had been removed.)

With the curtains out of the camera, the pivots and shafts of the take-up rollers are easily oiled. This is, of course, more difficult when the curtains are not removed. Be sure to oil the shafts on either end of the opening curtain take-up roller before installing the guide rollers. Also, insert an oiler between the ends of the closing curtain drum to lubricate the opening curtain drum shaft. Next, slip the shouldered brass bushings over the lower ends of the take-up rollers (with their shoulders, the smaller diameter, down) and lubricate their bearing surfaces with shutter oil.

Once all of the bearing surfaces on the drums and take-up rollers have been oiled, lay out the curtains in the correct positions they will occupy in the camera. Now, partially wrap the curtains around the drums and take-up rollers so that they can be conveniently inserted.

Replace the drums first, feeding the opening curtain drum shaft through the center of the closing curtain cam. Rotate the closing curtain cam until its notch straddles the pin on the top of the closing curtain drum. (You can test the correct assembly at this point by holding the closing curtain drum stationary with your finger -- if the closing curtain cam is correctly seated over the pin, you will be unable to move it in either direction.)

From the front of the camera, locate the screw adjacent to the rectangular viewfinder window on the top cover, Fig. 36. This is a cap screw which covers the infinity-adjusting grub screw within the rangefinder. By removing the cap screw, the technician can adjust the infinity alignment of the superimposed rangefinder images without disassembling the top cover. This adjustment will be covered in the reassembly portion of the text.

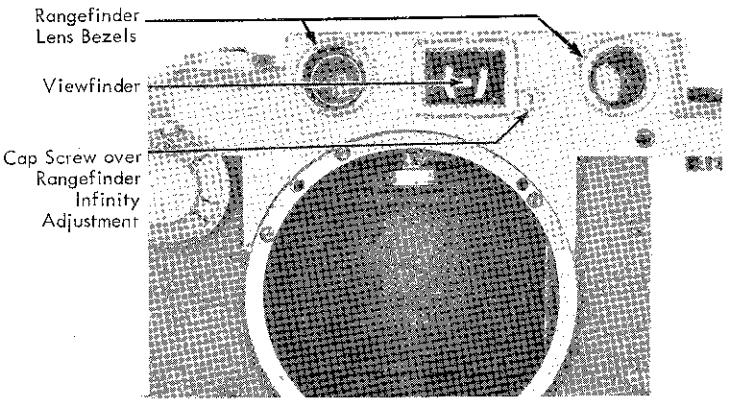


Figure 36

After taking out the cap screw, unscrew the bezels around the front rangefinder lenses, Fig. 36. To avoid marring the bezels and top cover, a 7/16" flexiclamp wrench should be used for this operation. You now have access to the two front rangefinder lenses, Fig. 37. The lens to your right (for the fixed rangefinder image) is threaded and can be unscrewed using a multispan wrench, while the other lens (for the movable rangefinder image) is friction-fitted and is lifted straight up from its mount.

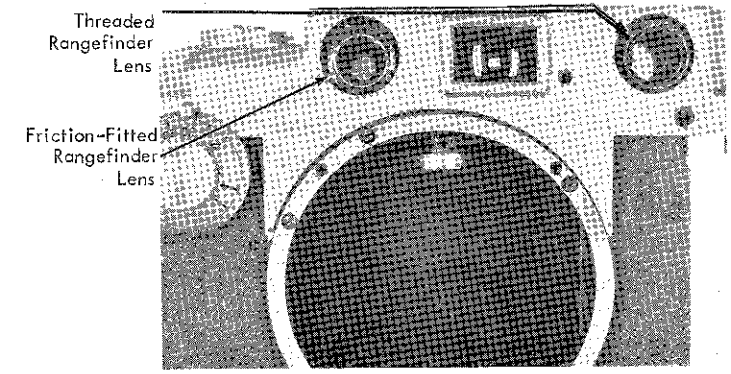


Figure 37

Except for the sync wire, the top cover is now free from the camera body. While gently pulling the top cover up, slightly spring it outward by the rectangular viewfinder window frame to clear the rangefinder assembly. Using a fine-tipped soldering iron, disconnect the sync wire from the contact plate at the point shown in figure 38. On reassembly, it will be necessary to resolder the sync wire to the contact plate before the top cover is installed.

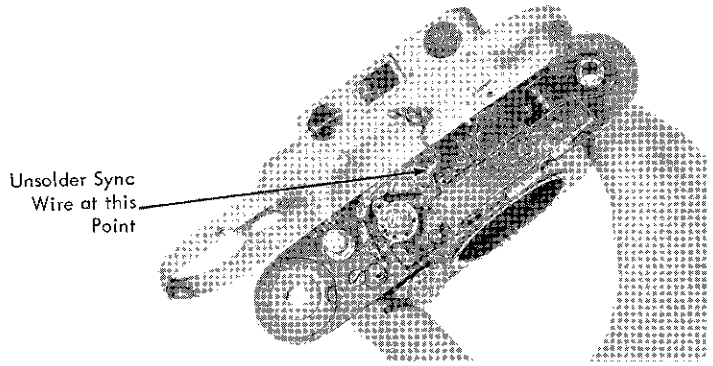


Figure 38

Place the top cover to one side and lift off the spacer washer which sits over the rangefinder focusing disc.

Both of the rear eye lenses simply press into place in the camera body. Once you remove the top cover, you can take out the lenses for cleaning. Be sure to note the proper positions of the negative rangefinder eye lens and the thinner positive viewfinder eye lens. But if you don't have to remove the eye lenses, here's a convenient trick -- just replace the viewfinder/rangefinder window frame with its two screws (figure 34). That prevents the eye lenses from accidentally falling out and getting lost or damaged.

Now, wind the curtains by turning the sprocket in the direction of the film movement. You can study the shutter action at the various speeds -- just lift and rotate the disengaging lever to the different settings. You may wish to replace the film take-up sleeve, the slotted counter gear, the counter dial, and the wind knob. That makes it easier to wind the shutter and examine its functions.

down toward the bottom of the camera. Notice that the upper section (which contacts the closing curtain latch and the upper retard lever) and the lower section (which straddles the pin on the closing curtain drum) are threaded together and held with a small setscrew, Fig. 91.

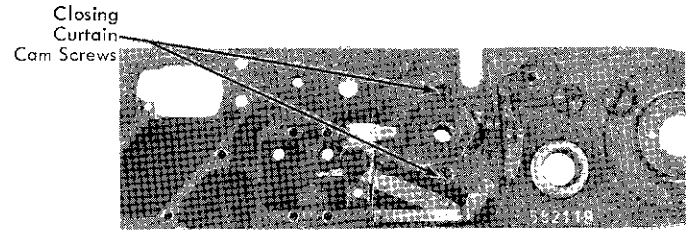


Figure 90

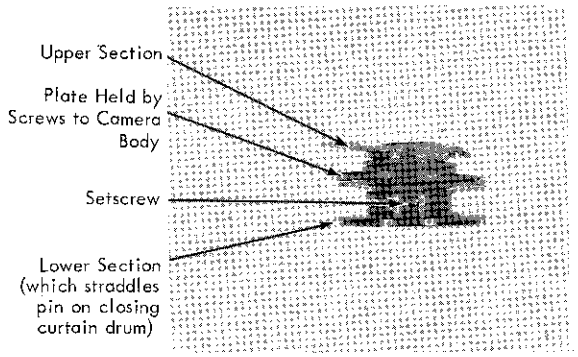


Figure 91

If you should ever have occasion to disassemble the blocking lever, intermediate lever for the rangefinder focus lever, safety switch or release slide, it is only necessary to remove their retaining screws. The upper gear train idler gears and the pawl which serves as the one-way clutch are simply held to posts on the camera body by E-rings. However, all of these parts would normally be left in place when servicing the camera.

REASSEMBLY OF THE LEICA IIIf

Once you've cleaned all the parts -- and replaced any defective parts -- you're ready to begin reassembly. Use shutter oil and moly-lube at the various lubrication points. All bearing surfaces should be lightly oiled. Use the grease on sliding and latch-

sprocket, Fig. 88. Wedge the sprocket in place to prevent it from turning and unscrew the notched plug with a multispan wrench. This will free both the sprocket and the sprocket gear. From the inside of the sprocket gear, examine the pin which contacts the release plunger screw during the wind cycle, Fig. 89.

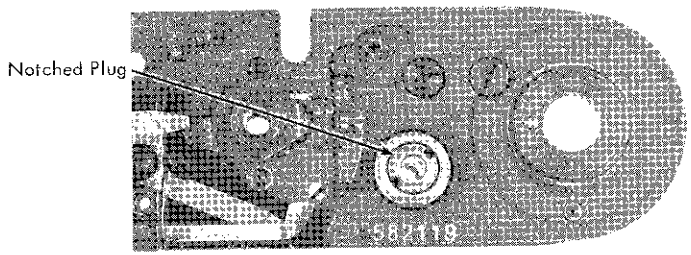


Figure 88

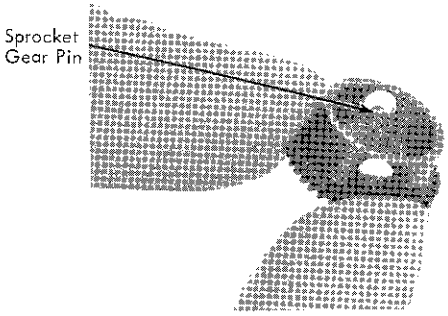


Figure 89

When you reassemble the sprocket, release plunger and first curtain wind gear, lubricate the individual balls with shutter oil. Besides being the proper lubricant, the shutter oil will facilitate reassembly by holding the balls in their tracks.

Unlike the sprocket, the closing curtain cam may be removed as a unit without disturbing the balls. The balls are located between the closing curtain cam and a plate which is held by two screws to the top of the camera body. After taking out the two screws, Fig. 90, the complete assembly can be worked from the camera. Rotate the closing curtain cam until it can be pulled

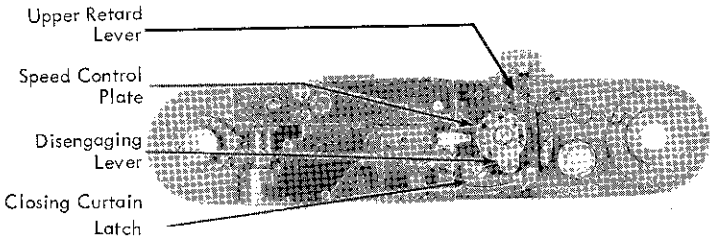


Figure 39

To study the operation at the slow speeds, first set the disengaging lever to the 1/30 second position, Fig. 40. Now, set and release the shutter at the different settings on the slow-speed knob. Notice that in this model the upper retard lever strikes a blocking plate at the "time" setting, Fig. 41. Although the blocking plate should normally be left in place, it can be moved forward or backward for fine adjustments after loosening its screw.

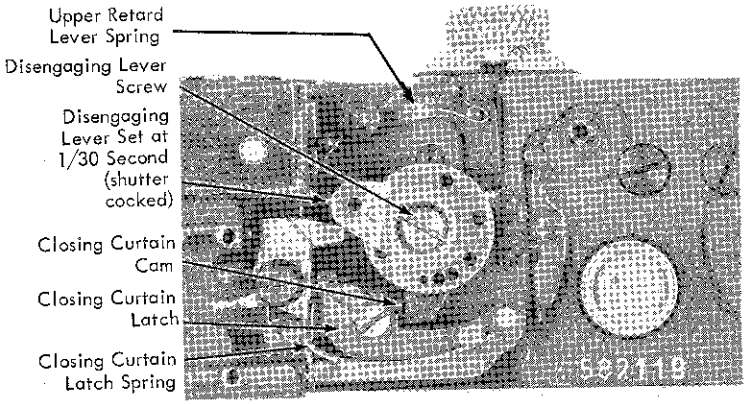


Figure 40

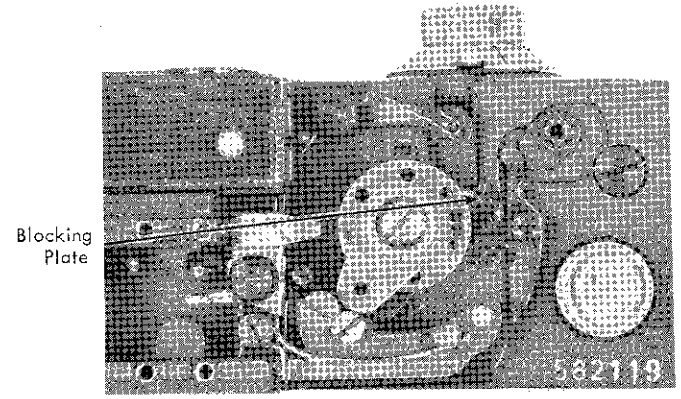


Figure 41

The disengaging lever strikes the vertical stud on the closing curtain latch to free the closing curtain. But notice that the Leica IIIf has two studs on the closing curtain latch. One stud sits quite a bit higher than the other. The disengaging lever strikes the higher stud when set to 1/1000 second. It strikes the lower stud at all of the other speeds.

By examining the speed control plate, you can see that the holes corresponding to 1/500 second and to 1/1000 second are quite close together (figure 44). If the same closing curtain latch stud were used for both speeds, these holes would necessarily overlap. Therefore, the second stud has been added for the 1/1000 second shutter speed.

At all speeds except 1/1000 second, the disengaging lever is allowed to seat flush with the speed control plate. Consequently, when the shutter is released, the disengaging lever will strike the first of the two studs on the closing curtain latch, Fig. 42. Then, in order to strike the higher stud, the disengaging lever must be elevated so that it passes over the top of the first stud, Fig. 43. To do this, the speed control plate hole corresponding to 1/1000 second is slightly smaller in diameter, thus preventing the disengaging lever from seating fully. Both of the closing curtain latch studs are eccentrics which may be turned to adjust the slit width, a shutter speed timing procedure which you will see later.

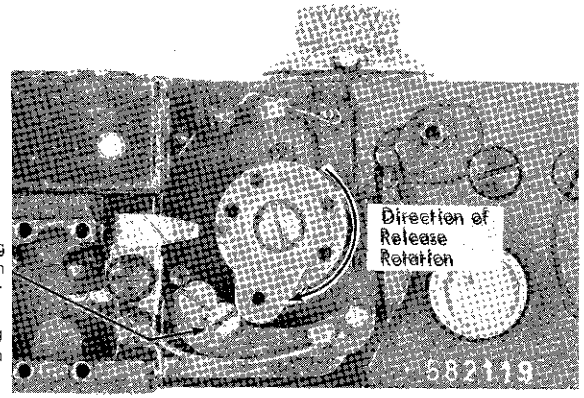

Disengaging Lever in Motion Striking Lower Eccentric Stud on Closing Curtain Latch
Direction of Release Rotation
582119

Figure 42

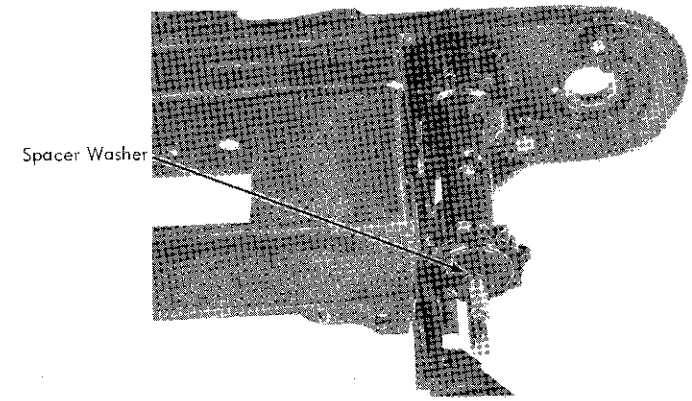


Figure 86

Two long screws passing through the release plunger must now be removed. One screw can be seen through the slot in the center of the sprocket, Fig. 87. (In the Leica illustrated, this screw has no purpose. However, when a delayed action is fitted to the same camera, the long screw provides the coupling between this mechanism and the release plunger. That is, after the delayed action has run down, it pulls the release plunger by the long screw to trip the shutter.)

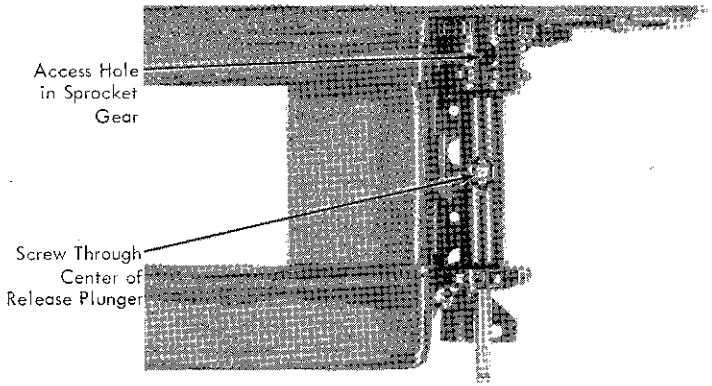


Figure 87

The second screw, the one which couples the release plunger to the sprocket, can be reached through the access hole in the side of the sprocket gear. After removing the two screws, pull out the release plunger toward the top of the camera.

Looking through the top of the release plunger flange, you can now see a notched plug which screws onto the top of the

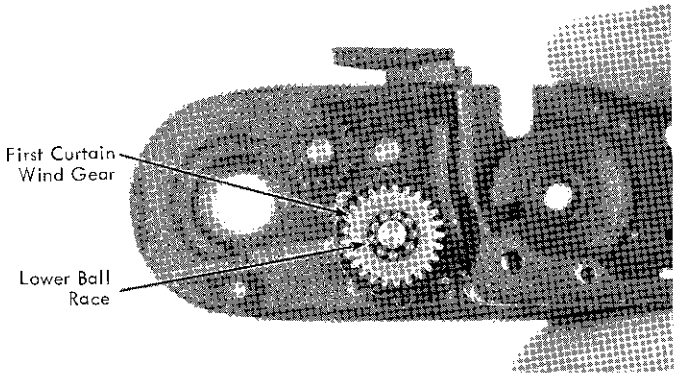


Figure 84

Use a fine tweezer to gently pick out the nine individual balls. Next, while holding the first curtain wind gear in place, invert the camera body. You can now carefully pull the first curtain wind gear down from the bottom of the release plunger — as soon as the parts are separated, the upper ball race will be free, Fig. 85. Once the first curtain wind gear and the balls have been disassembled, the spacer washer can be pulled from the release plunger, Fig. 86.

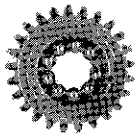


Figure 85

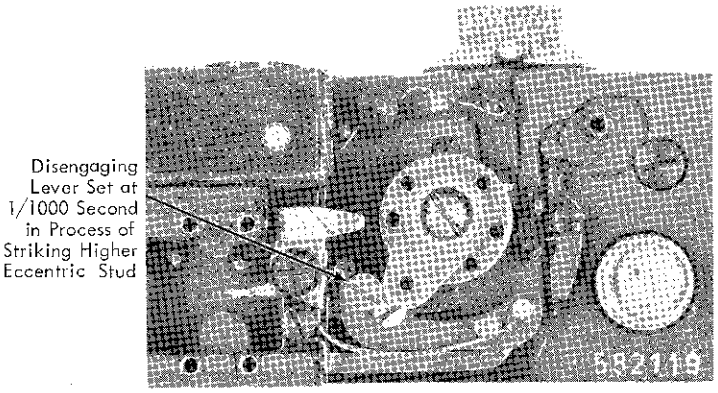


Figure 43

To remove the disengaging lever, take out its center screw. The compression spring which retains the disengaging lever against the speed control plate is located under this screw.

You now have a clearer view of the speed control plate with its small hole representing 1/1000 second, Fig. 44. The speed control plate and its washer can be lifted off the opening curtain drum shaft after taking out the retaining screw, Fig. 45. (Note: If the speed control plate is too tight to be lifted from the opening curtain drum shaft, it can be carefully worked off using a screwdriver blade or gear puller. If the speed control plate is bent during removal, it must be straightened prior to reassembly.)

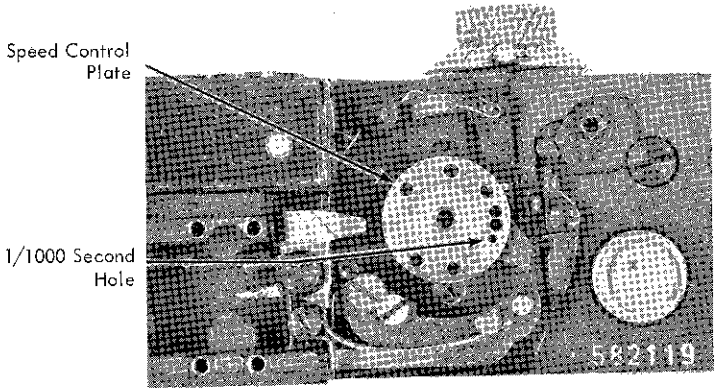


Figure 44

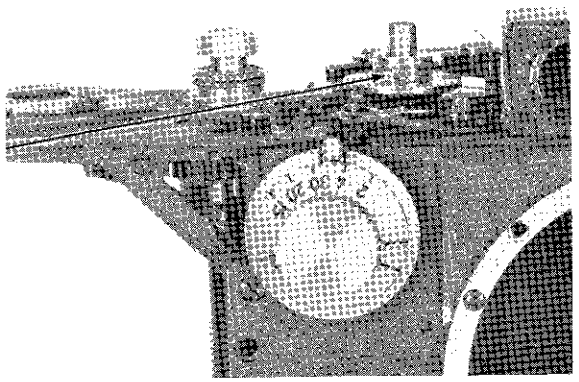


Figure 45

This reveals the top section of the closing curtain cam with its two lobes — the larger lobe which is intercepted by the closing curtain latch and the smaller lobe which contacts the upper retard lever, Fig. 46. Since the disengaging lever has been removed, setting and releasing the shutter at this stage will deliver "bulb" action.

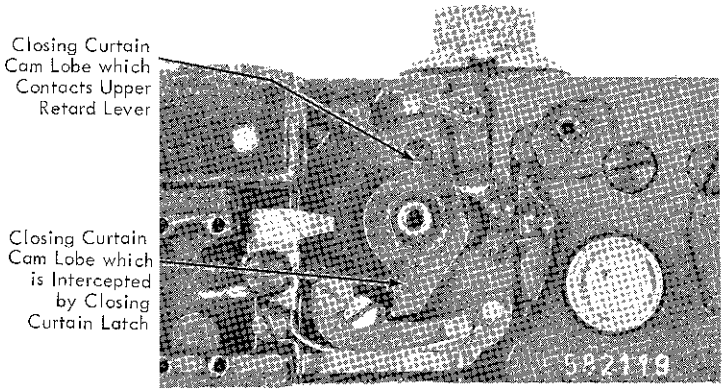
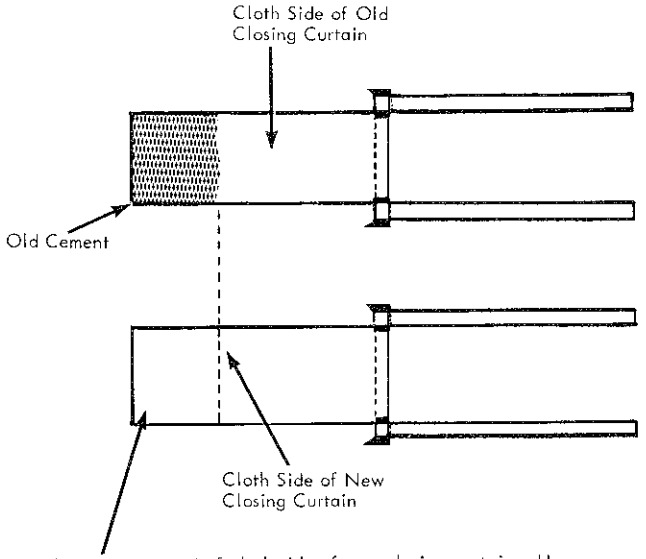


Figure 46

As previously mentioned, a safety switch under the closing curtain latch prevents the flash from firing while the curtains are being wound. You can observe the action of the safety switch by looking under the closing curtain latch while depressing the release plunger, Fig. 47. Notice that the lower section of the safety switch extends upward as a wiper arm. When the top cover is in place, the wiper arm sits in a recess, Fig. 48, where it brushes against the contact ring (which holds the fixed contact).



C. Apply cement to end of cloth side of new closing curtain. Use cement remaining on old closing curtain as a guide to determine how far back to apply the cement on the new curtain. Use the cement remaining on the old opening curtain tapes as a guide when cementing the new opening curtain tapes.

Figure 83

9. When you cement the closing curtain tapes and the opening curtain cloth to their respective take-up rollers, you may use any starting point on the rollers. However, make certain the opening curtain is perfectly square to its take-up roller. Also, assure that both closing curtain tapes are cemented to the closing curtain take-up roller so their effective lengths are exactly the same.

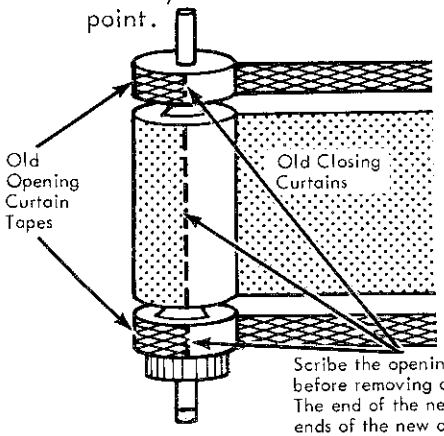
You will rarely have occasion to dismantle the parts remaining in the camera body. Both the first curtain wind gear and the closing curtain cam spin on ball races which are not self-contained. Therefore, if it is necessary to disassemble either the sprocket or the closing curtain cam (such as for parts replacement), you should again proceed with caution.

To take out the sprocket assembly, the first curtain wind gear must be removed from the bottom of the release plunger. The ball bearings are located in tracks above and below the first curtain wind gear. Keeping this in mind, pry off the E-ring at the bottom of the release plunger. Lifting off the two thin washers will now reveal the lower ball race, Fig. 84.

6. Apply the cement to the end of the new closing curtain. Use the cement remaining on the old closing curtain as a guide to determine how far back the cement on the new curtain should be applied.

7. Secure the new closing curtain to the drum, making sure that the end of the curtain is aligned with your scribe mark. Be very precise in this installation to eliminate the need for further adjustments after the camera has been reassembled.

8. Cement and secure the opening curtain tapes to the opening curtain drum in the same manner. Again, refer to your scribe marks to assure the exact starting point.


Old Opening Curtain Tapes
Old Closing Curtains
Scribe the opening and closing curtain drums here before removing old curtains and tapes. The end of the new closing curtain and the ends of the new opening curtain tapes must align with these scribe marks during installation.
A.

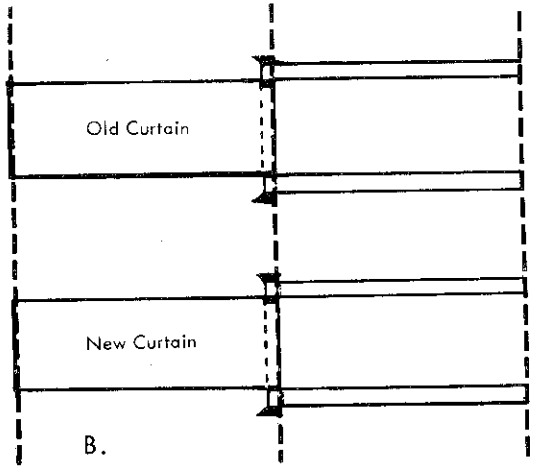


Figure 83 - Steps in Replacing Curtains

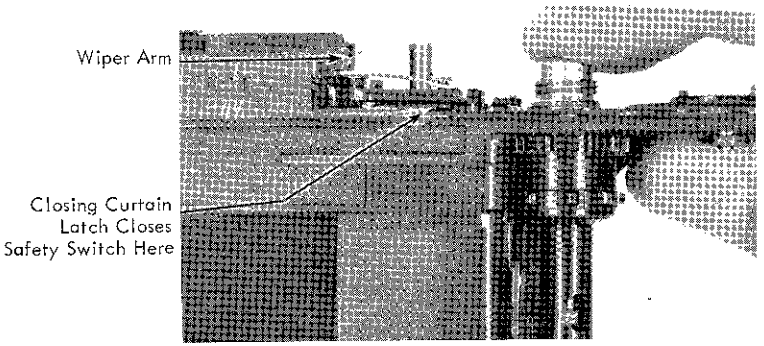


Figure 47

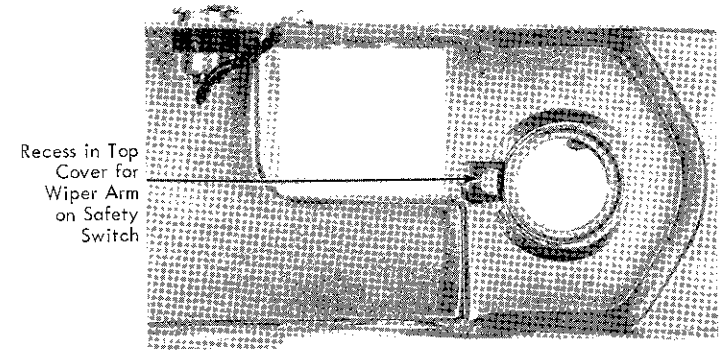


Figure 48

The upper section of the safety switch is wired directly to the sync nipple in the flash cord socket. Since the two sections are separated by an insulator, the flash circuit is broken in two places—by the sync contacts in the top cover and by the two free ends of the safety switch. Then, when the shutter is released, the closing curtain latch drops down to catch the closing curtain cam and simultaneously presses the two free ends of the safety switch together. Thus, as soon as the sync contacts are closed, the circuit will be completed.

When the advance/rewind lever is in the "R" position, allowing the film to be wound back into the cassette, the closing curtain latch is prevented from dropping down to catch the closing curtain cam. Locate the cam on top of the advance/rewind shaft, Fig. 49, which acts against one end of a spring-loaded blocking lever. When the advance/rewind lever is shifted to the "R" position, Fig. 50, the blocking lever is allowed to move under the closing curtain latch. Then, if the shutter is released, the

closing curtain latch cannot intercept the closing curtain cam. Consequently, the two curtains will travel across the focal plane in unison and prevent an accidental exposure during film rewinding.

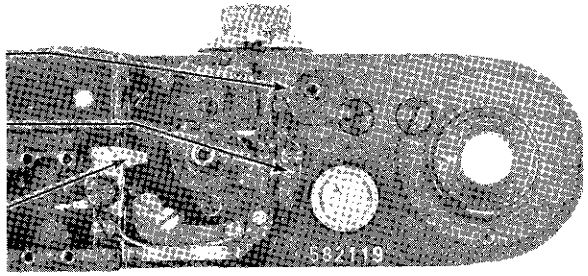


Figure 49

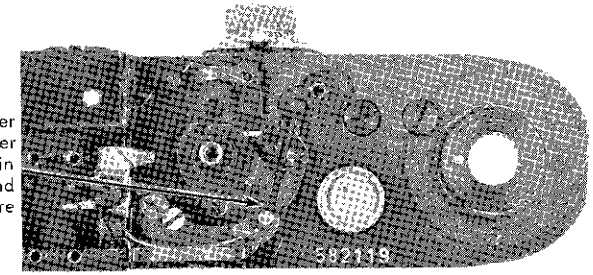


Figure 50

Besides blocking the closing curtain latch, shifting the advance/rewind lever to "R" also frees the sprocket. This is necessary because the sprocket must actually be able to turn in two directions — first in the direction of film travel when advancing the film, and then in the opposite direction while the film is being wound back into the cassette. To allow the sprocket to turn against the one-way clutch in the upper gear train, the sprocket gear is a separate, free-turning part. The coupling between the sprocket and the sprocket gear is provided by the release plunger. A long screw through the release plunger passes into an elongated slot in the wall of the sprocket, Fig. 51. The release plunger may then move up or down within the limits of this slot, but when it rotates it will carry the sprocket in the same direction.

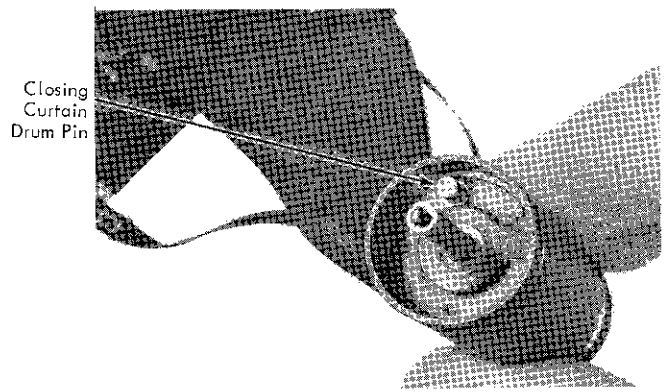


Figure 82

This would be the most convenient time to replace the shutter curtains if the original ones are damaged. The drawings in figure 83 illustrate the steps to be taken in curtain replacement, which are:

1. Before peeling the old curtains from their drums, scribe a line on the closing curtain drum at the end of the closing curtain.
2. Next, mark the ends of the opening curtain tapes on the opening curtain drum in the same manner. (It is extremely important that the new curtains be cemented at the correct starting points on their drums — even a slight error will result in incorrect curtain overlap.)
3. Peel off the old curtains and tapes from their drums and take-up rollers.
4. Thoroughly clean the old adhesive from the drums and take-up rollers.*
5. Check the lengths of your new curtains and tapes to verify that they are the same as the ones you have just removed.

*Note: The most convenient time to clean and lubricate the drums and take-up rollers is after you have removed the old curtains. These parts should be thoroughly cleaned in rinsing solution. Then, use shutter oil to lubricate the opening curtain drum shaft and the central shaft of each take-up roller. Lubrication procedures will be more thoroughly discussed during reassembly.

You can now turn your attention to the parts remaining in the camera body. With the camera body lying on its focal plane, lift off the shouldered brass bushings which slip over the lower ends of the take-up rollers, Fig. 80. Now, being careful to avoid catching the curtain tapes, slide out the drums, take-up rollers, and curtains as one assembly.

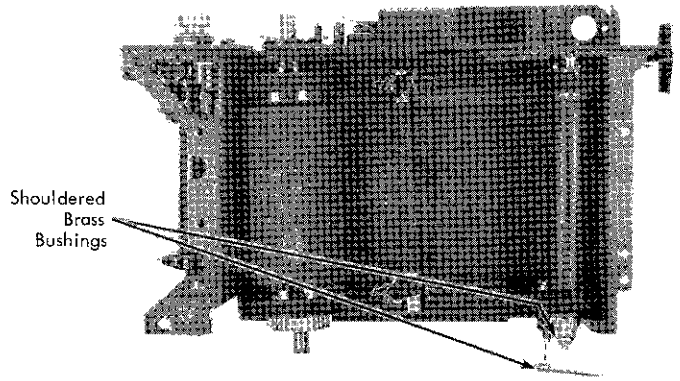


Figure 80

Notice that the guide rollers, Fig. 81, are different in shape, the larger one slipping over the bottom of the opening curtain take-up roller. From the top of the drums, locate the vertical pin on the closing curtain drum that rides within the slot in the opening curtain drum, Fig. 82.

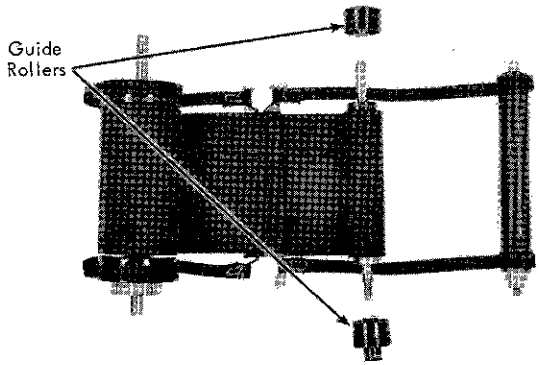


Figure 81

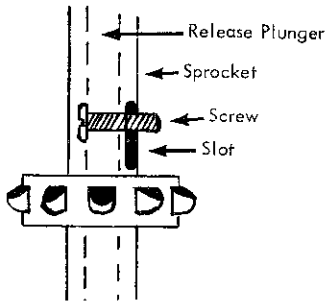


Figure 51 Sprocket Gear Removed

When film is advanced, the sprocket gear is turned by the upper gear train as you have seen. During this rotation, a downward-projecting pin within the sprocket gear contacts the long end of the screw in the release plunger, Fig. 52, turning the release plunger in the same direction. The release plunger in turn carries the sprocket to advance and meter the film.

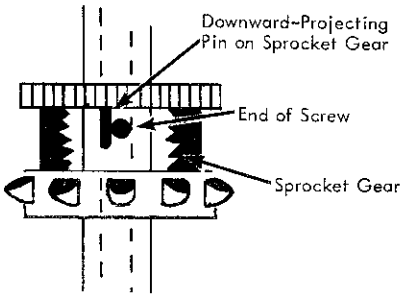


Figure 52

Shifting the advance/rewind lever to the "R" position lowers the release plunger vertically. Then, the long screw through the release plunger drops below the end of the downward-projecting pin inside the sprocket gear. This allows the sprocket to be turned in the opposite direction, pulled by the film being wound back into the cassette. The sprocket will carry the release plunger in the same direction, but now the screw in the release plunger passes under the pin in the sprocket gear.

Mechanically, this has the same effect as when the release plunger is depressed to trip the shutter in normal operation. As long as the release plunger is held down, its screw will be under the plane of the sprocket gear pin and the first curtain wind gear will be disengaged from the sprocket. The advance/rewind lever

simply makes it unnecessary to maintain downward pressure on the release plunger while rewinding the film.

To pull the release plunger down and lock it in the depressed position, a special set of parts is used. This mechanism is comprised of a second cam on the advance/rewind shaft (this one on the lower section of the shaft), a release slide mounted on the outside of the focal-plane wall, a long transfer pin, and an L-shaped spring held by one screw to the bottom plate of the camera.

Two shoulder screws hold the release slide to the side of the focal-plane wall, Fig. 53. Since its two screw slots are elongated, the release slide may move vertically within the slot limits. The position of the release slide is determined by the lower cam attached to the advance/rewind shaft.

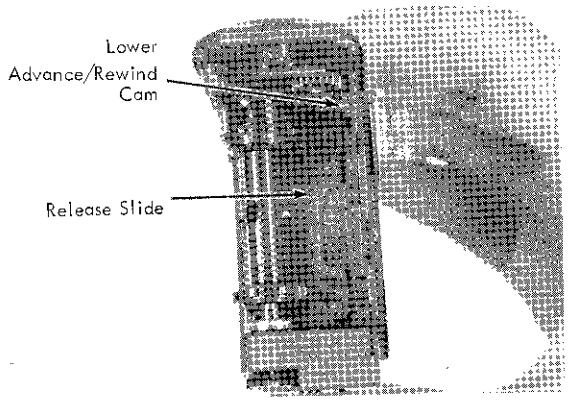


Figure 53 (in "R" position)

With the advance/rewind lever in the "A" position, the release slide is held at the uppermost limits of its screw slots by the transfer pin which passes through the bottom plate of the camera. The end of the transfer pin which contacts the release slide can be seen near the first curtain wind gear, Fig. 54. The other end of the transfer pin rests against the L-shaped spring on the bottom of the camera (the L-shaped spring is under the flat release spring and is not yet clearly visible). The L-shaped spring pushes the transfer pin upward. The pin, in turn, holds the release slide toward the top of the camera in contact with the lower advance/rewind cam.

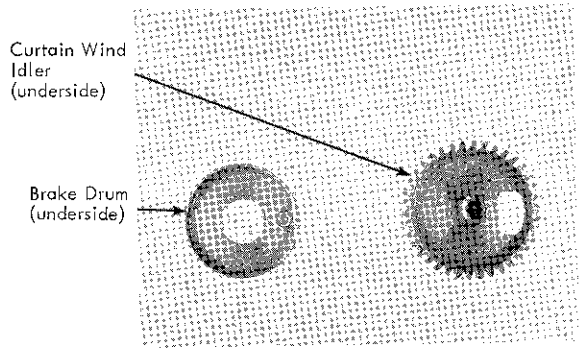


Figure 78

When the brake lever is in place, the flatted end of its shaft fits into the open end of the brake shoe (remaining in the bottom plate, Fig. 79). As you have seen, when the opening curtain reaches the end of the picture area after release, the opening curtain cam strikes the brake lever, swinging it aside. This spreads the brake shoe which contacts the inside of the brake drum. Thus, the opening curtain drum is arrested through the curtain wind idler, preventing the opening curtain from bouncing back into the focal-plane aperture.

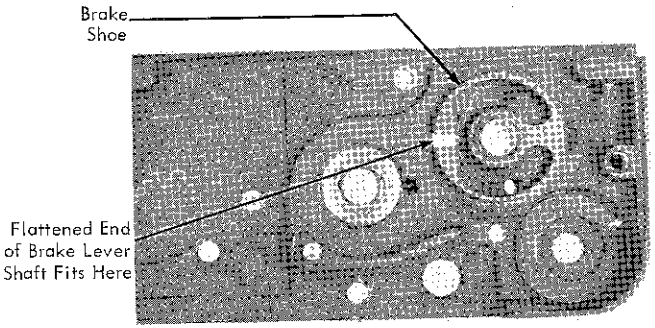


Figure 79

As long as the curtains are in the fully-released position, the stud on the brake drum will be braced against the end of the slot in the geared section of the curtain wind idler. Although the brake drum cannot rotate until the opening curtain cam releases the brake lever, the geared section can still turn in the wind direction within the limits of its slot. Consequently, as the lower gear train is advanced to wind the curtains, the curtain wind idler can turn to actuate the opening curtain drum. As soon as the opening curtain cam frees the brake lever, the brake drum will be picked up and turned by the other end of the slot in the geared section.

Although the particular model illustrated does not have a ball race for the opening curtain drum, the balls would normally fit in the track around the bottom plate bushing, Fig. 76. On the raised ridge adjacent to this bushing, locate the stop pin which limits the clockwise and counterclockwise rotations of the opening curtain drum. This pin rides in the slot around the lower end of the opening curtain drum.

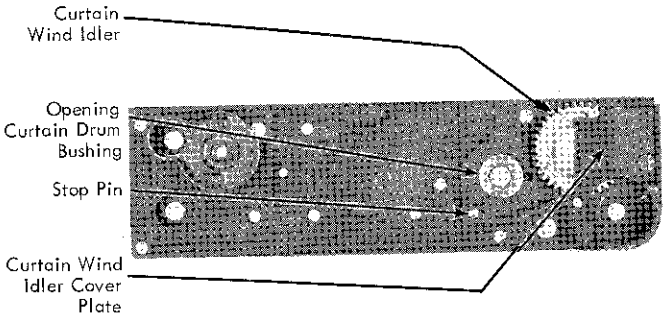


Figure 76

There is one gear, the curtain wind idler, remaining on the bottom plate. Notice that the curtain wind idler is in two sections: the outer geared section providing the connection between the first curtain wind gear and the drum gear, and the inner shell which acts as the brake drum. A stud on the top of the brake drum rides within an elongated slot in the geared section.

To examine the operation of the brake, remove the screw and plate over the curtain wind idler. Next, hold the curtain wind idler with your finger to prevent it from turning and take out the screw on the other side of the bottom plate, Fig. 77. Both sections of the curtain wind idler can now be lifted from the bottom plate, Fig. 78.

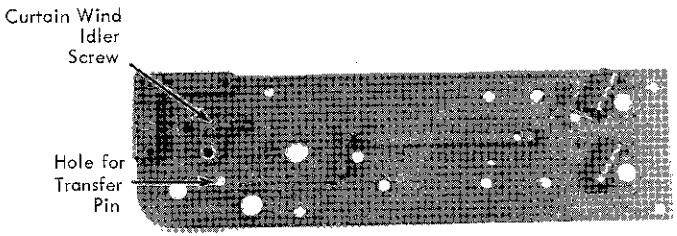


Figure 77

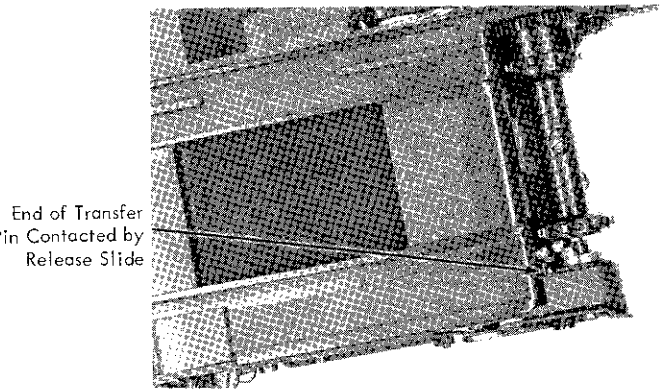


Figure 54

When the advance/rewind lever is shifted to "R," the lower advance/rewind cam is rotated. This pushes the release slide vertically downward, against the tension of the L-shaped spring. The transfer pin then forces the L-shaped spring against the underside of the flat release spring, moving it down to the release position. Since its shaft is hooked to the flat release spring, the release plunger is pulled down to disengage the sprocket. Until the advance/rewind lever is turned to the "A" setting, the release plunger will be held in this position and the sprocket will be free to rotate in the reverse direction. Resetting the advance/rewind lever to "A" allows the L-shaped spring to push the transfer pin and the release slide up to the top of the camera. The flat release spring can then return the release plunger to its normal location.

To remove the closing curtain latch, first disconnect the long end of its spring and take out the shoulder screw which holds the spring. The closing curtain latch can now be lifted straight up until its shaft clears the top of the camera body, Fig. 55. As

Figure 55

you have seen, the end of this shaft normally rests against the flat release spring at the bottom of the camera.

FRONT AND BOTTOM PLATE REMOVAL OF THE LEICA IIIf

From the front of the camera, locate the round hole near the bottom of the front plate, Fig. 56. The coupling between the cam follower for the slow-speed cam and the pallet lever in the escapement is visible through this hole. During reassembly, the hole allows access for properly aligning these parts (the cam follower is to the inside of the upturned tab on the pallet lever). The front plate can be lifted off with the slow-speed knob in place after taking out the five screws around its edge and the four screws around the lens opening. (Do not remove the screw at the lower left-hand corner of the camera at this time — this is one of the screws securing the bottom plate.)

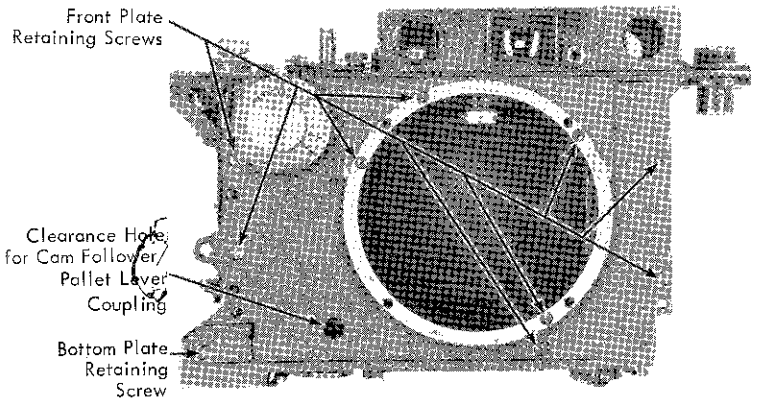


Figure 56

Of the three light shields within the focal plane, two are now loose. These were held only by the screws which you just removed from around the lens opening on the front plate. Before lifting out the light shield over the escapement and the one adjacent to the curtain drum, make a careful note of their positions. Both the light shield by the take-up rollers (which is part of the focal-plane light shield and cannot yet be removed) and the one by the drum sit to the inside of the upturned edges of the light shield covering the escapement, Fig. 57. If these are not reassembled correctly, they will drag on the curtains when the shutter is operated.

For example, consider that your test reveals that the opening curtain is not square, the slit narrowing from the top of the focal plane to the bottom. Now, if you hold the opening curtain drum against the tension and unwrap the tape from its top end, you can see the point at which the tape is cemented to the drum. Adding a small piece of the same kind of tape under the end of the juncture will, in effect, increase the diameter of the top end of the opening curtain drum. This will tend to pull the top end of the curtain toward the drum to correct the bar's alignment.

Cut a small section of curtain tape from a stock supply and temporarily place it at the junction of the curtain tape and the drum. When the curtain tape is wound back around the top of the drum, it will hold this section in place. Now, repeat your test to see if the amount of added tape is correct. If the slit is still tapered, use either a smaller or a larger section of tape (depending on the direction of the taper). After making any adjustments to the tape, be sure to repeatedly check the slit before cementing the added section of tape in place.

If it had been necessary to remove some of the original tape, your cut would be made at its extreme end — where the tape joins the drum. This would have the effect of reducing the diameter of the drum, consequently letting off a little more tape. Should the slit taper be severe, however, the curtain should be removed and recemented — altering the tape length excessively will tend to leave a loose fold of material in the curtain.

A more conventional method of curtain replacement requires the complete removal of the drums and take-up rollers. For this, of course, the bottom plate must be disassembled. First, hold the center of the take-up roller shafts with a small screwdriver and unscrew the worm gears in a clockwise direction. Now, take out the screw holding the L-shaped spring on the bottom plate, Fig. 74, and lift out the spring and the transfer pin.

There are three remaining screws which hold the bottom plate. Two of these, which also secure the base anchor plate, are located adjacent to the take-up rollers, Fig. 74. The third screw which you previously noted is at the front of the camera near the curtain wind idler (figure 56).

CAUTION: After you have removed these screws, be extremely careful while separating the bottom plate from the camera body. As mentioned before, some Leica models have a ball race at the bottom of the opening curtain drum shaft. This ball race is not self-contained. Thus, once the bottom plate is pulled from the opening curtain drum, the individual balls will be free. Unless you exercise caution during this procedure, the tiny balls can roll out and are easily lost.

opening curtain tapes are still remaining on the drums. These portions will be left in the camera even when the new curtains are installed.

Using the curtains you have just removed as patterns, cut the new closing curtain to the same length as the old closing curtain and cut the tapes of the new opening curtain to the same length as the tapes of the old opening curtain. Next, apply shellac or rubber-base cement (such as Pliobond) to the end of the new closing curtain. (The cement remaining on the old closing curtain can be used as a guide to indicate how far up the curtain the cement should be applied.) Wrap this curtain around its drum until its end is "butted" squarely against the cut end of the old curtain which you left in the camera. That is, the old and the new closing curtains will meet on the drum at the ends you have cut. Now, cement and wrap the opening curtain tapes around the opening curtain drum in the same manner — until the ends of the new tapes are against the cut ends of the old tapes remaining on the drum.

When you cement the opening curtain and the closing curtain tapes to their respective take-up rollers, you can use any starting position around the circumference of the rollers. However, be sure that the opening curtain is perfectly square to its take-up roller. Also, cement the closing curtain tapes so that the effective length of each tape on the roller will be the same.

Allow the cement to dry before applying tension to the curtains (the procedure for tensioning the curtains is given later in this text). Then, when the cement is dry and the take-up rollers have been tensioned, check the squareness of the curtains. Use the edges of the focal-plane aperture as guides to assure that the bars of the curtains are perfectly perpendicular in the camera. That is, restrain each curtain individually with your finger until you can see a hairline slit between the bar and the edge of the focal-plane aperture. Now, hold the camera up to a light source and view this slit. If the slit is tapered from top to bottom, the curtain under test is not square and must be adjusted.

It is important that you are very precise and accurate in your initial curtain installation. This should eliminate the need for subsequent curtain adjustment. If your tests show that the slit is excessively tapered, you must remove and realign the guilty curtain.

If the taper is slight, however, it can be corrected without removing and recementing the curtains. To do this, you can adjust the effective length of the tapes. Removing or adding small sections of tape at the point where the tape joins the drum or take-up roller will change the effective length and consequently correct the curtain alignment.

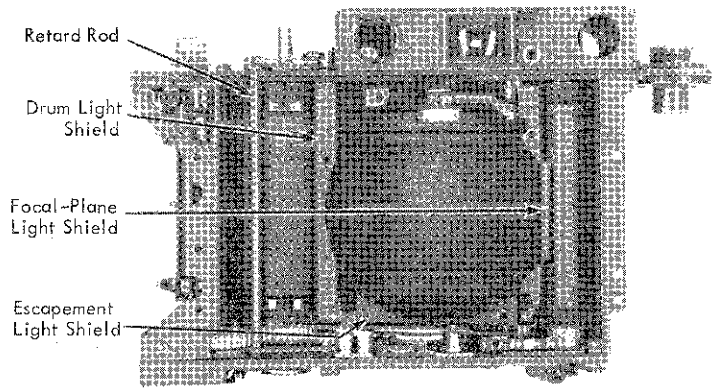


Figure 57

Two parts remained with the front plate when it was removed — these are the slow-speed cam and the cam follower which can be seen from the back of the front plate, Fig. 58. As previously

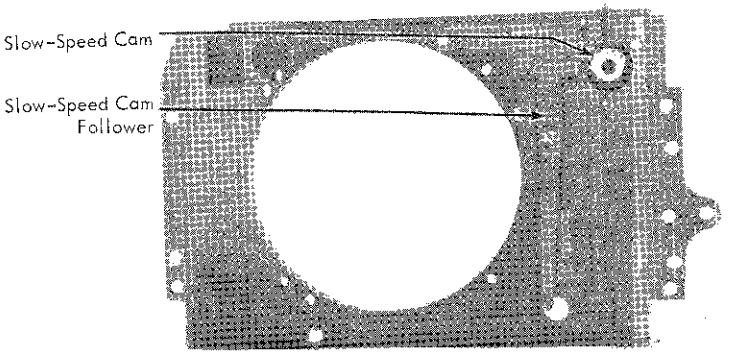


Figure 58

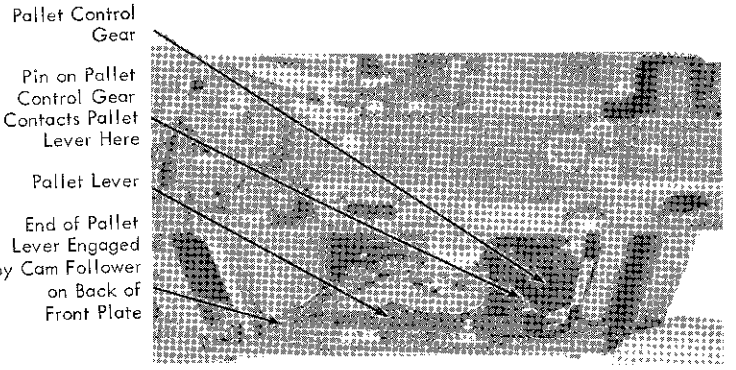

Pallet Control Gear
Pin on Pallet Control Gear Contacts Pallet Lever Here
Pallet Lever
End of Pallet Lever Engaged by Cam Follower on Back of Front Plate

Figure 59 (shutter released)

mentioned, the front surface of the slow-speed cam actuates the retard rod, while the side surface controls the cam follower. The lower end of the cam follower engages the hooked end of the pallet lever in the escapement, Fig. 59.

At all but the slowest shutter speeds (one second, 1/2 second, and 1/4 second), the cam follower pulls the pallet lever toward the curtain drum so the pallet cannot engage the star wheel. For the slowest speeds, the cam follower allows the pallet lever to move toward the take-up rollers under spring tension. Consequently, the pallet will be in position to engage the star wheel when the shutter is released.

To effect a rapid return of the escapement to the "ready" position, the opposite end of the pallet lever is contacted by the pallet control gear, Fig. 59, which meshes with another gear on the bottom of the closing curtain take-up roller. Once the closing curtain has crossed the focal plane after an exposure, the vertical pin on the pallet control gear strikes the pallet lever and forces the pallet out of engagement. The spring on the first gear segment can then return the escapement gear train to the "ready" position for the next exposure. As the curtains are wound, the pin on the pallet control gear, rotating with the closing curtain, moves away from the pallet lever and permits the pallet to drop into engagement on slow speeds, Fig. 60. Besides its primary function in disengaging the pallet, this action has a second value in the shutter: as it strikes the pallet lever, the pallet control gear also serves as a brake for the closing curtain.

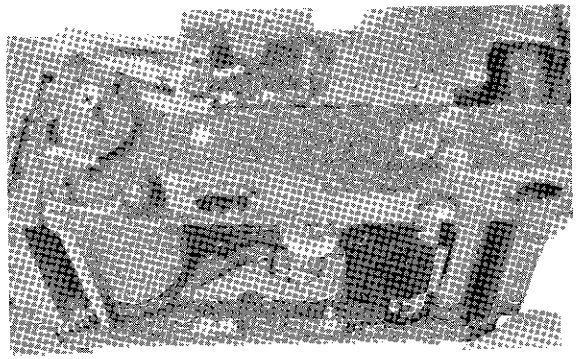


Figure 60 (shutter cocked)

The escapement mechanism is held in place by two screws on the bottom of the camera, Fig. 61. One of these screws also helps secure the flat retard rod spring. After removing the two screws, lift the escapement from the bottom plate.

casings, from the E-ring ends toward the screwdriver-slotted ends. As soon as the worms have been removed, the initial tension will be lost.

Although most technicians completely remove the drum and take-up rollers when replacing defective curtains, some prefer to do this without taking off the bottom plate. At this stage of disassembly, new curtains can be cemented in place with the drum and take-up rollers remaining in the camera.

To install new curtains without removing the bottom plate, first peel the opening curtain cloth and the closing curtain tapes completely free from their respective take-up rollers. Next, with the shutter in the released position, place a straightedge against the opening curtain tapes and the closing curtain where they wrap around the drums. Your straightedge will be in the position of the dotted line in figure 75. Using the straightedge as a guide, cut both the closing curtain cloth and the opening curtain tapes with a sharp razor blade.

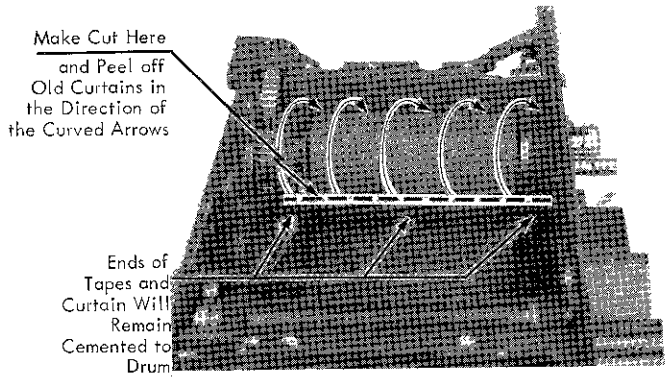


Figure 75

Working from the point of your cut, peel the old closing curtain cloth and the opening curtain tapes from the drums in the direction of the curved arrows shown in figure 75. Once the old curtains are free from their drums, they can be removed from the camera. However, the end of the closing curtain and the ends of the opening curtain tapes will still remain cemented to their drums. Do not remove this material.

Before the new closing curtain can be cemented in the camera, it must be cut to the same length as the old curtain you have just removed. Also, the tapes of the new opening curtain must be cut to the same length as the tapes of the old opening curtain. This is because part of the old closing curtain and the ends of the

In flush-cleaning the parts which were not removed, it is necessary to work the rinsing solution into each area of the shutter. This often means reaching around shutter curtains and interfering components to apply the solution in remote sections. Most of the metal parts may be washed using a small artists' brush saturated with the rinsing solution. More inaccessible areas may be cleaned by depositing the solution with a small eyedropper, hypodermic needle, or the tip of a screwdriver.

It is of prime importance that every bearing surface be thoroughly cleaned, including the take-up roller bearings, drum bearings, closing curtain cam bearings, and first curtain wind gear bearings. As soon as the solution has been worked into one bearing point, it should be blown out immediately with the compressed air before the next surface is cleaned. If you should accidentally get some solution on the curtains themselves, blow it dry with the compressed air. Be very thorough and complete in your cleaning procedure — if one bearing surface is left dirty, it can affect the entire operation.

With experience, you will be able to tell when the shutter is clean simply by listening to its operation. Until you gain this experience, however, you must rely on your thoroughness and diligence in the cleaning procedure. Since lubrication is also critical in this shutter, the points to be oiled or greased will be pointed out during reassembly.

Whenever it is necessary to remove the bottom plate, as for conventional curtain replacement or for hand-cleaning the shutter in the event compressed air is not available, the tension on the take-up rollers must be released. Of course, this will require complete retiming of the curtains on reassembly. To release the tension, first remove the E-rings from the ends of the tension-setting worms, Fig. 74. Now the worms can be pushed out of their

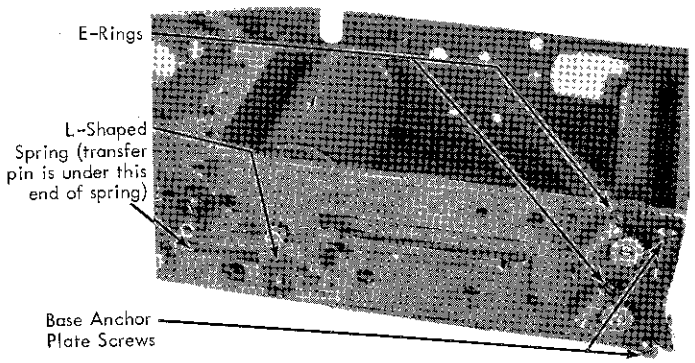


Figure 74

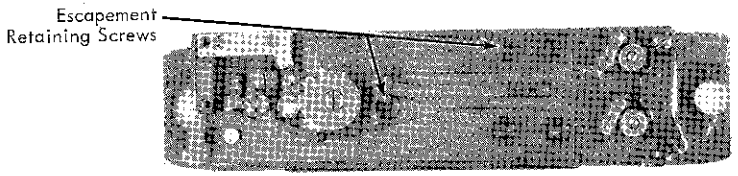


Figure 61

You can now see that the short gear train consists only of the first gear segment, an intermediate gear, the star wheel, and the pallet, Fig. 62. The depth of pallet engagement with the star wheel is limited by the stop bar on the escapement cover plate which contacts the pallet retaining screw. When the pallet is held away from the star wheel, it comes against the free end of the pallet lever spring. This merely serves to position the pallet, preventing any chance of contact with the star wheel at the intermediate speeds.

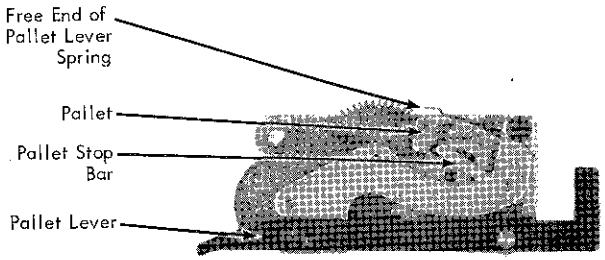


Figure 62

Working from the top of the camera, disconnect the hooked end of the upper retard lever spring and unscrew the brass nut that holds the spring. Lift off the spring and unscrew the notched nut which secures the retard rod retaining bridge, Fig. 63. You can now remove the retard rod (with its upper and lower retard levers attached) together with the retaining bridge.

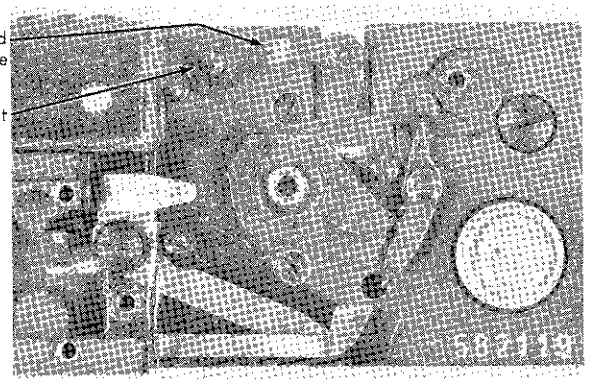


Figure 63

To detach the rangefinder assembly from the body, first take out the screw, washer, and rangefinder lever, Fig. 64. Next, remove the three screws securing the rangefinder assembly — two are located under the rangefinder lever position and the third is adjacent to the rewind shaft flange, Fig. 65. (Note: Record the respective lengths of these screws so they can be returned to their proper positions.) While lifting off the rangefinder assembly, be careful to avoid losing the viewing prism mask (the metal frame which fits in front of the viewing prism still remaining on the camera body).

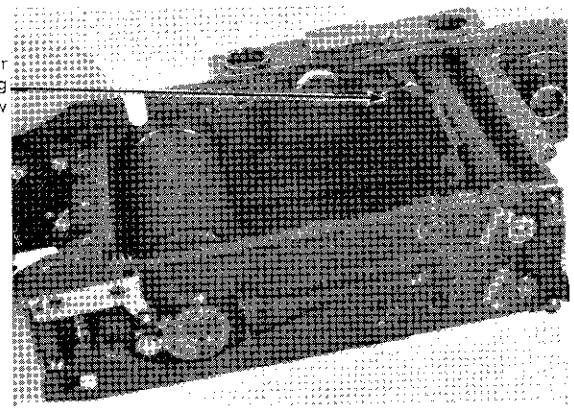


Figure 64

In routine cleaning, that's usually as far apart as you have to go. In fact, you shouldn't go further -- unless you have access to an electronic shutter-speed tester, such as a Comparascope. Without a tester, you should avoid disturbing the tension settings on the take-up rollers. That's because resetting the tensions is so critical. You need a tester to assure that the exposure is uniform at all areas of the focal plane.

However, most of the Leicas (and similar cameras) you will be servicing will only need cleaning and lubrication. At the present stage of disassembly, the camera may be conveniently cleaned without distrubing the tensions on the take-up rollers. Because the curtains themselves should never be immersed in a solution, a "flush-cleaning" method, requiring a compressed air blower, will be described for the parts remaining in the camera body. (Note: A hand blower is not normally sufficient for flush-cleaning a focal-plane shutter. For best results, a motor-driven compressed air blower with approximately 25 lbs. pressure should be used.)

Cleaning the metal parts you removed earlier is no problem. Unless the parts are unusually dirty, you can use a commercial rinsing solution as both the cleaning and the rinsing agent. But if there's grease "caked on" the parts, you may first scrub the parts in a commercial cleaning solution. Then, immerse the parts in the rinsing solution. Here, you're using the cleaning solution to remove all the dirt and grease. And you're using the rinsing solution to remove the cleaning solution. Naturally, you don't want to clean the rangefinder assembly this way -- it has optical components. Wipe off metal parts of the rangefinder with a dry cloth. Clean the lenses and prisms with lens-cleaning solution.

Thoroughly dry each part after taking it out of the rinsing solution. If this is not done and the parts are allowed to air-dry, an invisible film will remain. In some areas, as in the escapement, such a film can be harmful. To dry the parts, use a compressed air blower.

A commercial cleaning machine may also be used to clean the separate parts. This can be a time-saver when you start to do a large volume of work. The loose parts can be in the cleaning machine while you are flush-cleaning the components remaining in the camera body.

end of the focal-plane light shield will be completely free. However, the upper end is still tied down by a threaded cleat, Fig. 71. A second anchor plate (fitting between the cleat and the focal-plane light shield) also contains a threaded hole for another of the front plate screws. To remove the upper anchor plate and threaded cleat, take out the two screws located within the accessory shoe cavity on the top of the camera, Fig. 72.

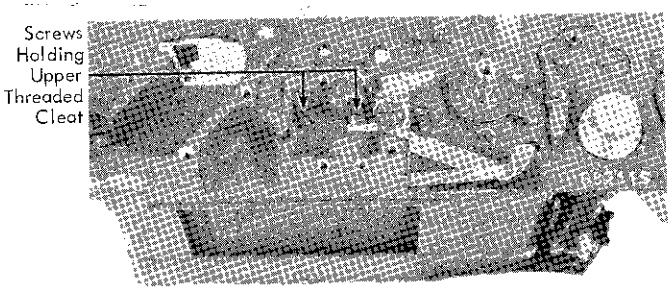


Figure 72

Although the focal-plane light shield is now loose within the camera, it is not easily removed without excessive bending. Therefore, you can take out the pallet control gear (held by one screw) and the two screws securing the gear's housing. By swinging this housing toward the outside of the camera, the focal-plane light shield can be lifted out easily, Fig. 73. (Note: If you are

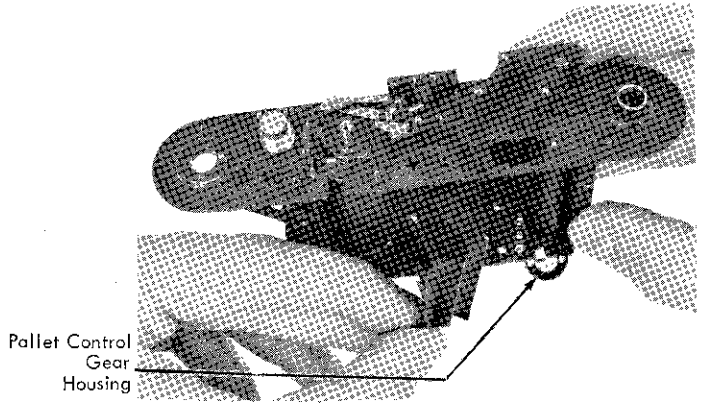


Figure 73

going to remove the bottom plate of the camera, it is not necessary to take out the screws holding the pallet control gear's housing. The focal-plane light shield will be completely free once the bottom plate is separated from the camera body.)

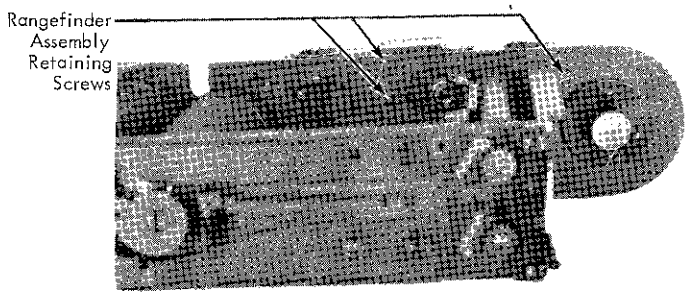


Figure 65

Looking at the underside of the rangefinder assembly, you can see a screw extending from within the eyepiece, Fig. 66. This screw slides a lens cell back and forth when the rangefinder focus lever is turned and normally seats in a slot in an intermediary lever on the top of the camera body, Fig. 67. The forked end of the intermediary lever is in turn engaged by a finger on the rangefinder focusing disc fitting over the rewind flange. This disc, containing the hole for the pin on the rangefinder focus lever, may now be lifted from the rewind flange.

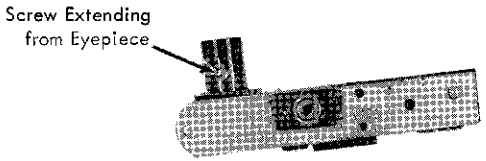


Figure 66

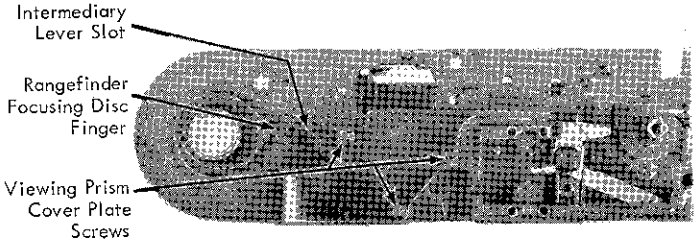


Figure 67

After taking out three screws, the brass cover plate over the viewing prism can be removed, Fig. 67. Now, lift out the spring washer (which is "bowed" upward) and the viewing prism, Fig. 68.

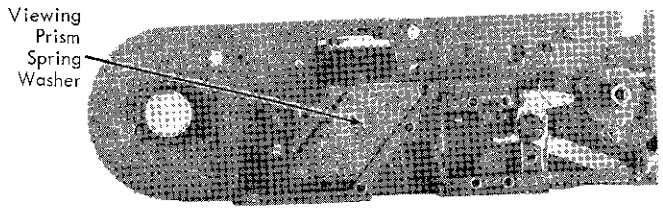


Figure 68

Next, turn the camera over to disassemble the parts remaining on the bottom plate. Take out the screw retaining the opening curtain cam and lift off the cam and washer. Notice that the end of the opening curtain drum shaft is squared, permitting the opening curtain cam to be replaced in any one of four different positions, Fig. 69. Of course, the opening curtain cam must be installed so that its notch will engage the secondary locking pawl when the curtains are fully wound.

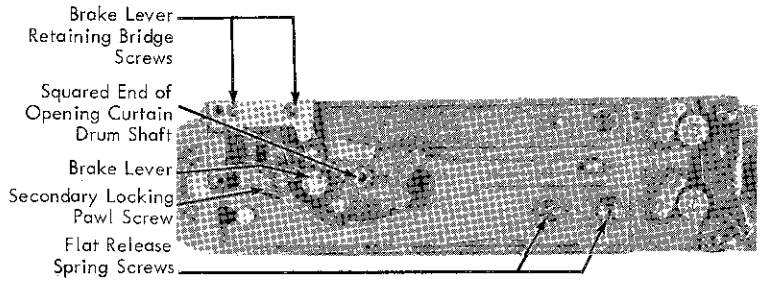

Brake Lever Retaining Bridge Screws
Squared End of Opening Curtain Drum Shaft
Brake Lever
Secondary Locking Pawl Screw
Flat Release Spring Screws

Figure 69

Remove the two screws holding the brake lever retaining bridge, Fig. 69. Take off the retaining bridge and lift out the brake lever. Remove the secondary locking pawl with its compression spring by taking out the central screw, Fig. 69.

Both screws holding the flat release spring, Fig. 69, pass into a threaded cleat which also secures the lower end of the focal-plane light shield, Fig. 70. (For reference in reassembly, observe that one edge of this cleat is contoured, with the thicker portion facing the front of the camera to your right.) While taking out the flat release spring screws with their washers, be careful to

avoid losing the threaded cleat. Now, slide the flat release spring toward the take-up rollers until the widest section of its slot is over the end of the release plunger. In this position, the flat release spring can be lifted from the bottom plate.

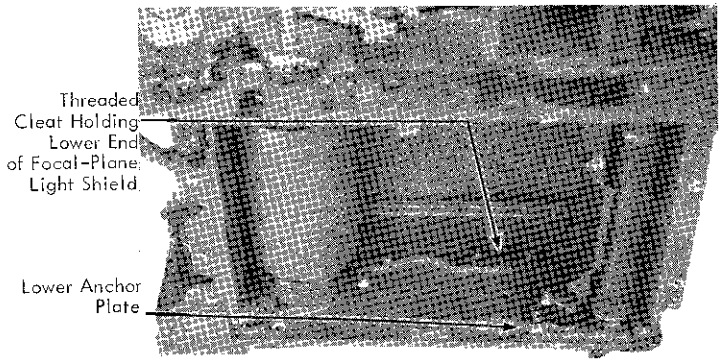


Figure 70

One screw (with a washer) still secures the flat retard rod spring. This screw threads into an anchor plate on the inside of the focal plane, Fig. 70. (Notice that the vertical section of the anchor plate contains a threaded hole for one of the front plate retaining screws.) After taking out the screw, the anchor plate and flat retard rod spring can be removed.

The lower end of the focal-plane light shield is now held by only one screw which was previously obscured by the flat release spring. Once this screw, Fig. 71, is removed, the lower

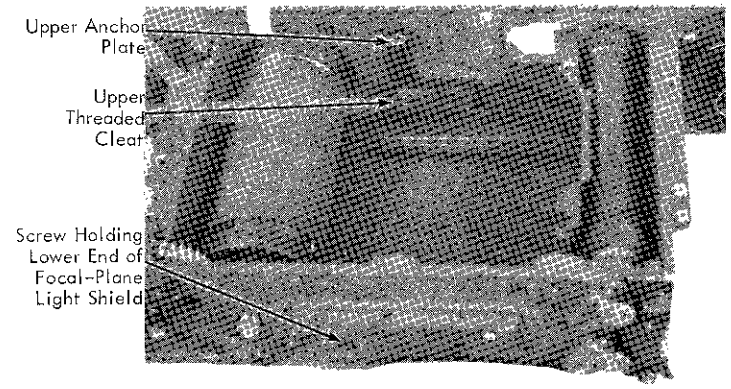


Figure 71